THE

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GERMANY AND WIRELESS WORLD SERVICE.

IN these days wireless telegraphy is the work of all works about which the civilian may know nothing at all by actual experience. This is quite as it should be, but from a very cursory consideration of the matter and a common-sense weighing of the more reputable reports issued from various sources, it is quite evident that wireless telegraphy has played no small part in the war so far, and is regarded by the enemy as of immense importance not only during the war but also thereafter.

Let us hasten to explain that we intend to make no indiscreet disclosures, but only to comment upon the general trend of enemy wireless policy during the past 10 months, and the ambitions clearly fostered by Germany in respect of her "wireless future."

Commencing with last June, it will be remembered that on June 19th, on the occasion of his visit to Eilvese, the Kaiser exchanged wireless greetings with President Wilson and a number of other eminent Americans, but trans-Atlantic communication is said to have been imperfect at that date. Little more than a month later, every German submarine cable was cut by England within a few hours of the declaration of war, and but for wireless telegraphy, Germany would have been isolated as regards rapid communication with the outer world—particularly the States and the Far East, where such a vigorous campaign of mendacity has since been prosecuted.

Whether due to the spur of the war or whether (as is far more likely) due to full utilisation being made of equipment which had been kept in reserve and not previously used regularly at its maximum output, the capabilities of German stations are claimed to have been greatly increased since last autumn. There is no reason to doubt that this is the case, and it is quite probable that the number and power of really large stations in Germany are materially greater than is generally known.

Recently the French *Le Temps* made some remarkable statements concerning the degree to which Germany had organised her wireless news network. It is said that since the outbreak of war the power of the Sayville (Long Island) station has been raised from 35 to 100 KW., the necessary apparatus and the three 155-metre towers now in use being built in Germany and exported *viâ* Rotterdam. The effect of this is that to-and-fro wireless communication can be maintained between Germany and the German Ambassador in the States, even during the summer months, when atmospheric conditions are unfavourable in the west Atlantic.

There is said to be a German-controlled wireless station in each of the 46 States, besides 4 in Mexico and 16 distributed over South America, and all under direct orders from Sayville. This system disseminates a vast mass of the well-known brand of news prepared by Germany for export, and it is said that to-and-fro communication between

European and American headquarters occupies 12 or 15 hours a day, most of the remaining 24 hours being spent in blocking low-power working by the Allies.

As before mentioned, it is impossible for any ordinary civilian to verify these general facts (which could so easily be verified in normal times), but there seems little doubt that the Allies would gain more than would compensate for any inconvenience inflicted on themselves, by systematically "blockading" Germany by wireless, as she is already blockaded by every other means.

What the German Pacific Squadon and commerce raiders owed to wireless—both by exchange of messages between ships and land stations and by "listening" for victims—is at least partially obvious from published dispatches and a general consideration of their career. It is certainly not too much to say that "more than one German vessel now interned, but still safe and sound in American harbours, would have been in the depths of the Atlantic or Pacific but for the extensive and excellent organisation of German wireless service."

What the enemy now owes daily to wireless in the way of reports and instructions to and from Zeppelins and submarines, and to spy messages, which traverse half the world in apparently innocent form before reaching their destination, can only be surmised by us who are not permitted to practise wireless in any form. But there is no reason to doubt that the enemy has benefited as greatly by wireless on land as by sea in the past, and may be doing so still. The organisation is undoubtedly there. The only question is whether effective "blocking" is in force. Unlike a submarine cable, the ether cannot be severed, but it can be "choked," and with the choice between rendering radio-communication more or less impossible to ourselves, and permitting the broadcast dissemination of "news" which may well have unsuspected method in its apparently reckless madness of untruth, the former appears to be the lesser evil.

Whilst more and more conclusive evidence appears daily of preparation and organisation for the collection and distribution of wireless news and instructions, as cunning and complete as that displayed by the enemy in every other direction, commercial and military, there is on foot in Germany a movement pretending that the world is in danger of subjugation to a British wireless monopoly, and urging Germany to establish a world network! Acquainted as we are becoming with the amazing intricacy and deceit of German machinations in every walk of life, there is still a grave danger that we may underestimate the power of a defeated Germany to continue such intrigues.

How far we are from having established anything approaching a wireless monopoly, and how impossible it is for any nation to do so in times such as these, when the cost of erecting opposition stations is of no moment, and no respect is paid to patents which in normal times might preserve monopolistic control to the patentees of a particular system—these points need little emphasis. As a nation we attach great importance (perhaps not sufficient importance in the past) to establishing an Imperial chain of radio-stations, and, as we can justly claim to be the centre of a united Empire spreading over the whole world, we are perfectly entitled to establish such a series of stations without incurring the charge of attempting monopoly and world domination.

With Germany the case is different. She had few colonies in the past and in future will have fewer, yet she aspires to establish a network of stations exceeding anything ever suggested in this country. Her avowed intention is to furnish an independent medium for the distribution of news and the spreading of "German genius, glory, and greatness" abroad—in fine, the stations she seeks, some of which she already has, are simply part of the great scheme for placing the world under the German yoke.

Mediæval, melodramatic and absurd as such pretensions would have appeared a few months ago, we have since learned that they are indeed the essence of modern German *kultur*. The dissemination of news and "influence" by every possible means has been reduced to a science by Germany. That the actual execution is incredibly clumsy and tactless in many instances does not diminish the excellence of the organisation *per se* or reduce its potentialities when properly administered. It is idle to deny that Germany excels in united national effort or that the interlacing of her whole industrial and social fabric does not enable her to effect results which are apparently financially impracticable. It is futile to suppose that when Germany is defeated, as she must be defeated, and subjected to a crushing financial burden, she will not remain an industrial rival of no mean order. In every branch of industry the crisis must be acute, and one of these branches is radio-telegraphy. By every indication Germany is bent on establishing a world-wireless-news service which shall rival the existing British cable system, and on backing the German Telefunken system against the British Marconi system. In order that she may not succeed in this aim it is only necessary to realise what her success would mean, to assess adequately the energy she will direct to the effort, and, finally, to see that our own wireless development is healthy, vigorous, and, piece by piece, in conformity with a pre-arranged and comprehensive scheme.

Enemy Manufactures Prohibited.

So long as men of British blood remember the barbarous methods that have been adopted by Germans, all goods suspected of the slightest trace of enemy-taint will be anathema. Teutonic writers and industrial leaders are displaying a confident belief—more or less forced, we imagine—that so excellent is the state of German electrical manufacturing and German industrial organisation, that after peace has been reached, necessity, efficiency of production, and low price will allow their goods to run freely in all markets before very long. As they "wait and see" they may find the truth to be less acceptable than their present fiction. We are, at any rate, content to believe that the revulsion of feeling that has been created wherever people dwell beneath the Union Jack, will be a serious barrier to their commercial efforts for long years to come. We never have been unmindful of the various factors which will affect the situation favourably for German manufacturers, and to some of these matters we may have occasion to refer again shortly; but to describe a thing as German will be to give it a nauseous and offensive character, and that factor will be one of the most influential at work. The Coalition Government has come into office without either political party having relinquished any of its former great principles, but the application of those principles may be varied in the presence of unprecedented conditions, and probably the future will witness the adoption of a definite policy encouraging the purchase of British manufactures with British public money. Yet it is useless for us to wait until legislative policies and enactments approve; after all, the legislature is there to do what the great mass of the people desire. Public opinion sometimes leads in sentiment before it follows in action. Even "Push and Go" men do not push and go until necessity drives.

It is as well, therefore, that the very strong anti-German feeling which exists everywhere in the United Kingdom and in the British Colonies—omitting for the moment the lands of our Allies—should find some definite expression and take such a concrete form that it shall not be subject to the dangers which might affect it if it remained an indefinite sort of sentiment simply fashionable and convenient in war-time.

We have already referred to the widespread agitation for erecting an almost insurmountable barrier against German goods, and even against German people, that exists in certain of the Colonies. Time alone will tell how far that agitation can be successful, and how far British electrical firms will find it possible to rise to the occasion, and do their part to make it so. We have also referred to the undesirability of British municipalities placing contracts with neutrals that were open to suspicion during war-time. But there is a desire in some quarters for a very definite policy to be accepted and acted upon now which shall control the course of matters quite independently of any legislative developments, and not merely during hostilities, but after they have ceased. A sign-post in this connection has been set up by the Birmingham Corporation Electricity Department, which we

are given to understand has had the following special clause printed on its orders to contracting firms :—

"*A condition of this order is that the goods supplied have not been manufactured in Germany or Austria.*"

This clause represents not only the strong views held at Birmingham, but those of many other borough electrical engineers who may not yet have had an opportunity to carry their Committeemen or councillors to the length of putting down their convictions with such precision in print. The Birmingham clause, it will be observed, not only shuts the department against any German or Austrian manufactures which are already in the country and may be on offer, but as far as it is feasible for it to do so it prevents any possibility of such manufactures getting into the country through firms in neutral countries. Buyers naturally have to exercise their own discretion, and very carefully so, in the latter connection. But the Birmingham clause, if we perceive correctly, is not merely designed to guard against those two possibilities; we regard it as a policy on the part of the Corporation which will continue to be acted upon after the war. It may not indicate any particular change from the past spirit of Birmingham as a British industrial centre, but we believe that it is new as a definite clause in contract conditions there, and unless we misjudge the sentiment of these days there are scores of other Corporations and public bodies who will feel that the only course for them to adopt, in order faithfully to fulfil their trust as guardians of the public purse, is to support British industry wherever it is at all possible, and where it is not to deal only with those countries which are unmistakably neutral. Where Birmingham leads no doubt others will follow.

Copper. AFTER a period of comparative weakness, during which prices of standard copper receded about £7 from the best figures recently registered, there has been another series of firm markets. The main outlines in the situation have not undergone any change, there being an overwhelming consumption in connection with war requirements, and every prospect of a continuance of this salient feature for a wholly indefinite period. There has been a fair amount of business doing in speculative quarters, but a considerable portion of the rather large bull account till recently open on the market, has been liquidated, and to this extent the situation, from a technical point of view, has, therefore, been improved. There is no intention on the part of leading dealers in the market to encourage speculation at this juncture, and the line they are taking is a very reasonable and proper one. Mr. Lloyd George has made it quite clear, moreover, that the Government are not going to stand any nonsense in the way of speculative movements, and it may, therefore, be taken for granted that should there be any attempt made on the London market to hoist values speculatively, swift action will be taken by the authorities. It is recognised that this action may even involve the forced closing of the London Metal Exchange, and this is a contingency which it is felt must be avoided by every possible means. There have already been too many attempts made to push up prices against buyers, and it is quite time that any attitude of this kind was rendered impossible, if not by innate patriotism, then by compulsion.

Of course, America really controls the market by controlling the output, but, on the other hand, American speculators have always made very free use of the London Metal Exchange to further their purpoess for the manipulation of the markets. The feeling as regards copper generally, is that, notwithstanding the high level of prices, the position is fundamentally perfectly sound. Producers have things practically their own way, for there is not much secondhand material to be picked up, and demands have yet to be filled to a very large extent, although the buying may be of a spasmodic character. Both Russia and France have been taking considerable quantities, and the former continues to put forward inquiries on a liberal scale. We are reaching the time, no doubt, when production should begin to tell upon the situation in America, but for the time being, producers there are able without difficulty to market every lb. of copper they produce, and they make no secret of the belief that the war demands will absorb everything which the mines, smelters, and refineries are able to turn out, and this regardless of price. Some of the leading trade experts in America believe that the termination of the war will be followed by a still greater demand for copper, for the declaration of peace must find the markets everywhere barren of supplies, yet, nevertheless, faced with a demand for industrial purposes sufficiently great to peg prices on a high figure for a long period of years.

THE ELECTRICAL EQUIPMENT OF SUBMARINES.

BY W. O. HORSNAILL, A.M.I.E.E.

THE present war has given special prominence to the important *rôle* played by electricity in connection with the means of offence and defence, every kind of electrical apparatus being extensively made use of both on shore and afloat. This feature is particularly pronounced in the submarine, which depends entirely upon its storage batteries for power, light and heat when submerged, while on the surface a further use of electrical energy is to be found in the wireless equipment.

The most important application of electrical power in a submarine is for the propulsion of the vessel underwater, when it is impossible to obtain the air needed for running the oil engines. Shunt motors are used for this purpose, and they are mounted on the intermediate shafts between the oil engines and the propellers, clutches being provided between these shafts and the engines, so that the latter can be disconnected when the vessel is running submerged. While cruising on the surface with the oil engines running, the motors either turn idly or are connected up as dynamos for charging the battery. So far submarines have always been fitted with twin screws, hence two motors are needed for each vessel. The power of the motors varies between 33 per cent. and 45 per cent. of the engine power, the tendency in the largest submarines being towards the lower figure. In the British "E" class the motors are reputed to be of 400 H.P. each, and the vessels are said to be capable of cruising underwater for six hours. It must not be supposed, however, that the battery has a capacity of 800 H.P. for this period, as the power needed to give the reputed submerged speed of 11 knots is comparatively small. In this connection it may be stated that the resistance to propulsion of a submarine underwater is less than half that on the surface, and this in spite of the drag caused by the conning tower and other excresences, together with the increased skin friction. The reason for this remarkable feature is that the resistance to a ship on the surface is largely caused by the waves thrown up during its passage through the water. When submerged no waves are produced, and the resistance consists entirely of skin friction. The above statement is amply supported by tests of the powers needed to propel a submarine on the surface and underwater over a range of equal speeds. Then again, the speed on the surface is 17 knots as against only 11 knots under water, and the resistance varies roughly with the cube of the speed. In view of these facts a liberal estimate of the power required when submerged gives us about 200 H.P. or 100 H.P. for each motor. The motors are made larger for the purpose of charging the battery quickly, as if they were only of the power necessary for propulsion, this operation would take a prohibitive period. Furthermore, the motors are used for reversing on the surface and for giving extra power to the engines during limited periods when a sudden spurt is needed.

The earlier batteries for submarines were of the acid type, but recently both Edison and "Alklum" batteries have been installed. In either case the cells are carried in separate watertight compartments. This arrangement is very necessary when acid is used, as, should sea water reach the cells, chlorine would be given off and would poison the crew.

In addition to the large electric motors used for propulsion many others are to be found in underwater craft for

air-compressing, pumping, ventilating, heaving up the anchor, and other purposes. A detailed drawing before us of a 1,500-ton submarine in course of construction, shows no less than 12 electric motors applied to these duties, without reckoning the wireless equipment and the gyro-compass with which these vessels are now always fitted. Furthermore, all cooking is done by electricity, as any other source of heat would use up the air and give off noxious gases.

Obviously the above described electrical equipment includes motor starters, switchgear and instruments, but as these appliances are of standard patterns in use for similar purposes on shore they need not be particularised here. In fact, the entire electrical outfit of a submarine consists of standard apparatus excepting as regards the usual requirements demanded by Admiralty specifications.

The submarine has come to stay, in fact there are indications that it will eventually oust every other form of warship. If the latter proves to be the case, the underwater fleets of the future will offer a big field for motors, batteries and other electrical gear.

There are no insuperable difficulties in the way of building submarine battleships and cruisers of equal power to any surface craft now in existence, it is simply a question of development which will, no doubt, be expedited by the present war.

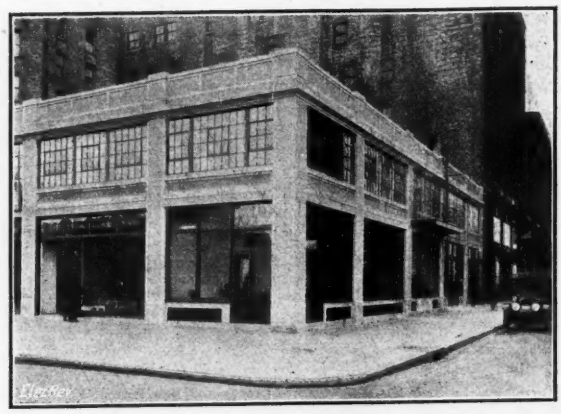
Not only will the Great Powers go in extensively, or entirely, for submarine fighting ships, but the smaller nations will find them an invaluable means of defence against more powerful foes.

In the face of all this future business for the electrical industry, it is our duty at the present time to devise some means for destroying submarines faster than the Germans can build them. The main difficulty is to locate underwater craft when submerged, and any instrument which can do this will deserve the undying gratitude of the nation. German submarines spend much of their time lying on the bottom during daylight hours, as this plan conserves their supplies of oil and electricity; and if our ships can only discover their exact position, it is comparatively easy to capture them. Already submarine sound instruments are proving of value for discovering submarines when under way below the surface, but obviously such apparatus is useless for finding vessels lying still on the bottom.

NEW YORK'S CO-OPERATIVE ELECTRIC VEHICLE GARAGE.

The new co-operative electric vehicle garage, situated at Central Park West and Sixty-Second Street, New York, is now in full operation with a quota of 100 privately-owned electric pleasure-cars garaged and cared for beneath its roof, and, although it has only been open since February last, the scheme is reported to be succeeding beyond the fondest hopes of the originators. The establishment is the largest electric vehicle garage in New York, and the task of establishing it was not an easy one; the various difficulties were, however, all overcome by the New York Electric Vehicle Association, with the assistance of three of the leading American manufacturers of electric vehicles—the Detroit, Baker, and Rauch & Lang concerns—all of whom have made the new establishment their New York headquarters.

The garage, which also comprises handsome showrooms for new cars facing Central Park, has a total floor area of 30,000 sq. ft., more than half of which is devoted to the storage of cars, the rest being taken up by offices, service, stock-rooms and repair-shops. The garage proper embodies a number of unusual features, more particularly with regard to the electrical and battery-charging equipment. The charging board is one of the largest so far constructed, and controls 48 charging outlets of varying capacities, it being able to deal with batteries ranging from 24 lead cells, with a charging rate of 8 amperes, to a 60-cell Edison battery requiring 100 amperes. The average charging time is from four to six hours. The leads from the charging board are so arranged that the batteries can be charged *in situ* on the cars without it being necessary to shift the latter

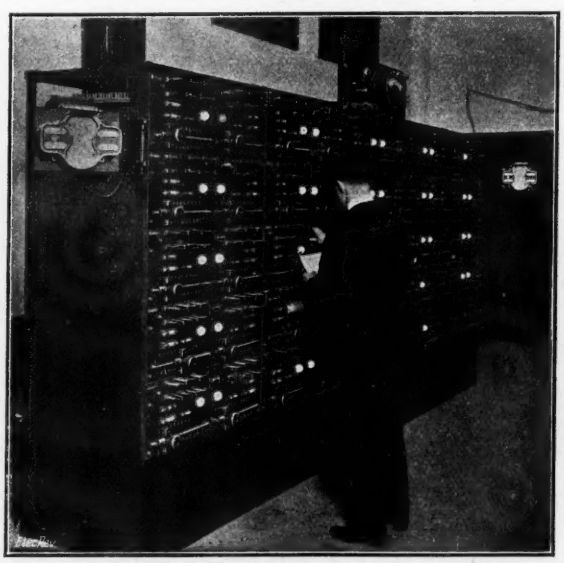


The New York Electric Vehicle Association's Co-operative Garage.

from their usual positions in the garage. The necessary current is taken from the mains of the New York Edison

Washing an Electric Car.

Co., six cables, having a combined capacity of 3,200 amperes at 120 volts, or 400 kw., being employed to con-

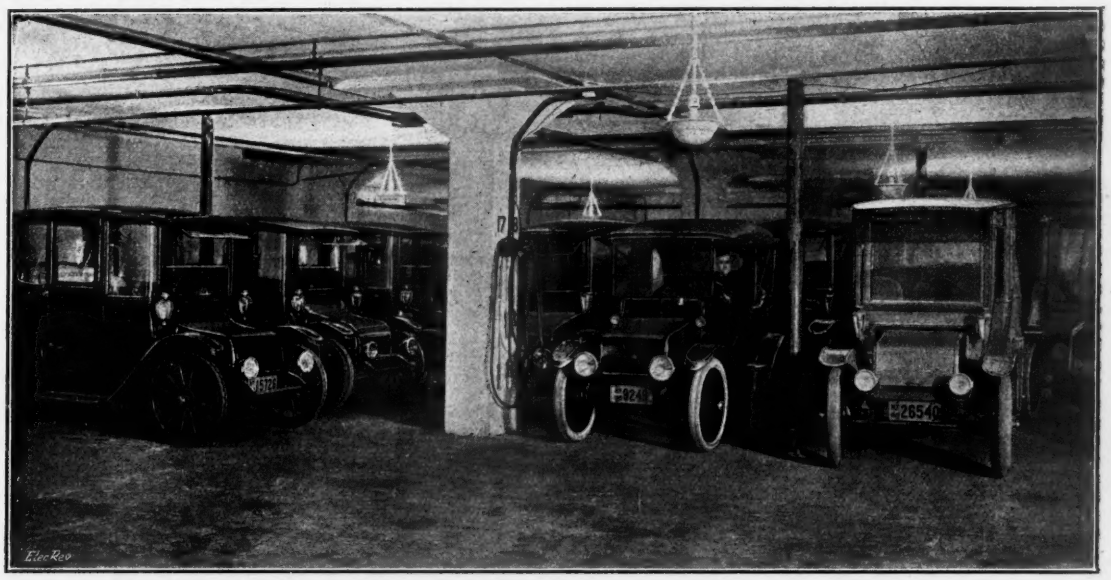


Vehicle Battery Charging Control Board.

duct the current to the charging board. The meters have a capacity of 200 kw., almost sufficient to warrant a special

panel in a generating station. Within the building there are about 8,000 ft. of copper wire of large capacity, and 1,400 ft. of conduit, exclusive of the connecting cables used in the electrical system of the garage.

The fact that the undertaking is being run under the ægis of the New York Electric Vehicle Association, which comprises in its membership all the leading electric vehicle interests in the American metropolis, has placed an official seal on the establishment as being as perfectly adapted for its



VIEW OF THE FIRST FLOOR, NEW YORK ELECTRIC VEHICLE ASSOCIATION'S GARAGE.

purpose as is possible, thereby assuring for it a standing that, it is claimed, no other electric vehicle garage possesses. The cost of garage service at the establishment is £9 per month, this charge including the garage, washing and cleaning of the car, and the charging and periodical inspection of the battery.

Our illustrations give some idea of the scope and working of this establishment, which will, no doubt, at some future date, find its counterparts in this country,

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Union Flexible Coupling.

MESSRS. BOVING & CO., LTD., of Union Court, Old Broad Street, E.C., have recently placed on the market a new form of flexible

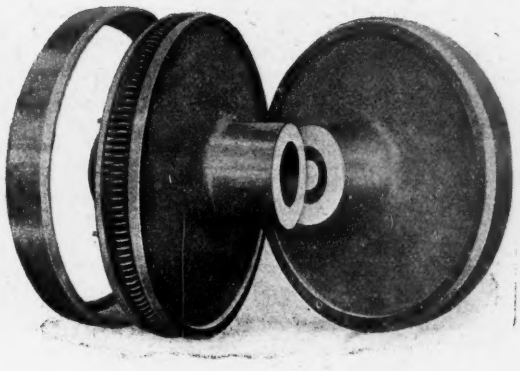


FIG. 1.—UNION FLEXIBLE COUPLING, SHOWING ARRANGEMENT OF SPRING.

coupling which, we understand, is successfully meeting a wide range of uses, having been applied to large slow-running rolling mills, high-frequency generators running at 1,850 R.P.M., and to turbine and Diesel engine plants.

Its construction is exceedingly simple, consisting of two facing disks, with inwardly projecting teeth near their peripheries which engage with the coils of a circular helical spring, the arrangement being indicated in fig. 1. Both halves are left free for either radial or axial movements; while the subdivision of the transmitting units allows each to be comparatively weak and flexible, yet collectively to form a powerful coupling.

Since each coil of the spring transmits only a small portion of the load, the spring does not tend, as a powerful spring would, to overshoot the normal position when the load is momentarily released, and thus accentuate torque variations. For low speeds cast-iron disks and steel springs are employed, while for high speeds or in large sizes, an all-steel construction is employed. The clutch sizes listed range from 7 lb. to nearly 7 tons in weight.

"Witton" Ironclad High-Pressure Switchgear.

A representative example of a mistake-proof ironclad switchboard, manufactured by the GENERAL ELECTRIC CO., LTD., of Witton, is shown in the accompanying fig. 2. This switchboard was constructed for a large steel works which had rapidly to be adapted for the production of war munitions. It was built up of a number of "Witton" mistake-proof switch panels, each self-contained, and on arrival at the works the only erection work necessary was the connecting together of the different panels and the connecting up of the cables.

This switchboard, which is one of a large number of similar pattern now passing through the Witton works, was constructed to control, amongst other plant, a 750-KW. motor-generator manufactured by the General Electric Co. to convert three-phase power

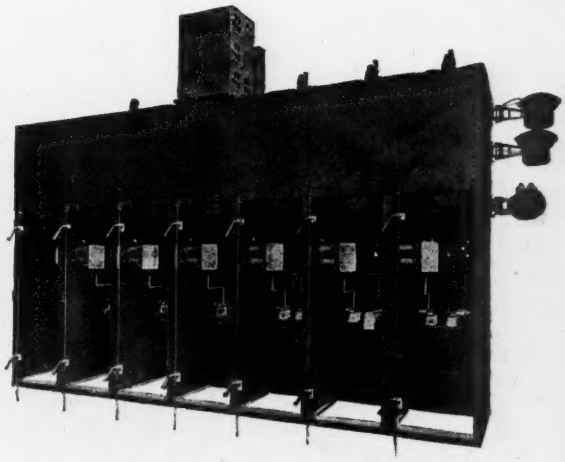


FIG. 2.—BACK VIEW OF "WITTON" BOILER PLATE MISTAKE-PROOF MAIN SWITCHBOARD.

at 3,300 volts, 50 cycles, to continuous current at 550 volts on the three-wire system, a static balancer being part of the equipment.

THE WORK OF THE NATIONAL PHYSICAL LABORATORY IN 1914-15.

THE annual report of the Executive Committee shows that the work of the Laboratory was greatly affected by the war, and some 50 members of the staff joined the Colours—nearly 25 per cent.; adequate provision was made for their payment, the retention of their posts, &c. Forty-two members have been sworn in as special constables. Under the circumstances, the normal research work of the Laboratory has been delayed. Owing to the war, the formation of the National Research Laboratory for Telegraphy and Telephony at the N.P.L. has been postponed. The Committee on the Lighting of Factories and Workshops has completed its first report. Great accuracy has been attained in the reproduction of the fundamental electrical standards; five mercury tubes made at the N.P.L. compared with five made at Tokio showed a mean difference of only eight parts in one million, and Weston cells made at Petrograd agreed with the Laboratory standards to within one part in 100,000. Inductance standards are equally satisfactory, and the range and accuracy of the measurement of large high-frequency currents have been greatly improved. The speed of measurement of alternating currents has been increased, and the research on the rise of temperature of underground cables has brought out a series of interesting results. Progress has been made in the photometry of electric standard lamps.

The electrical tests made in the Physics Department amounted to the following totals:—Electrical Measurements, 191 (previous year, 259); Electrotechnics, 5,080 (3,828); Photometry, 410 (1,142). The income for the year fell to £39,653, a reduction of £4,060, and the fees for tests fell by £5,124 to £20,017. Special investigations brought in £1,612, as against £2,533. The Treasury grant for Aeronautics rose from £5,311 to £7,475. The total expenditure was reduced from £40,968 to £39,573, and the net result was a credit balance of £81, as compared with £2,745 in the previous year. The sum to the credit of the General Fund is now £2,347. The Hon. Sir C. A. Parsons has presented a sum of £1,000 to the Committee for additions to the equipment.

The report of the Director includes a list of the members of the staff on active service.

Physics.—In July last year Drs. Giebe and Schultze, of the Reichsanstalt, visited the Laboratory and compared a resistance coil with the N.P.L. standards; its absolute value was also determined with the Lorenz apparatus, the greatest difference from the mean of nine measurements being 2·9 parts in one million. Comparison with the coil standards showed that one International ohm = 1·00052 true ohms, a result identical with that obtained in 1913. The Reichsantalt absolute measurements were in very close agreement with those made at the N.P.L. The investigation of the Weston normal cell was completed, and the results are being prepared for publication. A cell containing a small quantity of free acid with a grey depolariser (the grey colour being due to the presence of minute globules of mercury) appears to be the most constant form.

The Schuster magnetometer is practically complete. The horizontal-intensity magnetograph is capable of measuring changes of one-millionth of the C.G.S. unit of magnetic intensity lasting for one second only. It was found that unless the damping of the suspended system was critically aperiodic, the magnitude of the changes could not be accurately estimated.

An inductometer with a wide range of self-inductance has been constructed. Two standard self-inductance coils from the Reichsanstalt were compared with the N.P.L. standards, the latter coming out respectively 14 and 8 parts in 100,000 lower than the former. Future coils will be wound in single layers on marble bobbins, to ensure that the temperature coefficients shall be both small and definite. The dimensions of the primary standard of mutual inductance were all carefully remeasured, and slight changes were found, which, however, almost compensated for one another, the final value for the mutual inductance being seven parts in 1,000,000 less than the old value. A 600-watt alternator, giving frequencies from 150 to 800 cycles per second, has been installed. Methods of measuring large high-frequency currents were investigated, and it was found that air-core current transformers gave very accurate results up to 2,000,000 cycles per second; small iron-cored transformers also gave excellent results, and current transformers of this kind are quite suitable for very large high-frequency currents. With the aid of large standard condensers, the range of working of wavemeters has been extended to wave lengths of 50,000 m. Progress has been made with the research on magnet steel for the Institution of Electrical Engineers.

Electrotechnics.—The new realisation of the pentane unit of light in electric sub-standards is now complete. The unit so obtained agrees with the original N.P.L. unit of candle-power within less than 0·1 per cent. It has been found that the changes usually ascribed to the humidity of the atmosphere may, in part, be due to changes of temperature, but the usual method of analysing the results does not readily permit the two effects to be differentiated. The work on the cascade series of lamps has been completed up to the set running at 1·5 watts per candle; direct comparison between the fundamental set and the 1·5-watt set gave the same result as that by the cascade method, the Lummer-Brodhum photometer head being used always. The colour of the light depends mainly on the temperature of the filament, irrespective of whether the radiating substance is carbon or tungsten; the group of lamps giving light of the same colour as that from the pentane lamp operates at 1,616° C., whilst that running at 1·5 watts per candle has an operating temperature of 2,300° C. The series is being continued by means of gas-filled standard lamps up to an efficiency of 0·6 watt per candle.

Experiments were made which established the relation between the lumens per watt of carbon and tungsten lamps and the temperature of their filaments, as follows:—

$$\text{Log}_{10}\, L/W = 21{\cdot}51 - 4{\cdot}58 \log_{10} T - 185 \log_{10}(1 + 155/T)$$
$$\text{Log}_{10}\, L/W = 23{\cdot}31 - 5{\cdot}1 \log_{10} T - 185 \log_{10}(1 + 155/T).$$

These expressions have a physical basis, and agree with the observed values from the lowest to the highest values of temperature in carbon and tungsten (vacuum) lamps. The colour of light from molten platinum was found to be identical with that from a carbon-filament lamp operating at 4·75 watts per mean spherical candle, corresponding with about 3·8 watts per M.H.C.P. The value of the coefficient of reflection of the white cards used in connection with illumination photometers has been investigated. Measurements in connection with the Home Office Committee on Factory Lighting have occupied much of the time of the department.

(To be continued.)

NEW RUSSIAN CUSTOMS TARIFF.

THE Board of Trade have recently issued a Blue Book showing the rates of duty leviable on goods imported into Russia under the new decree which has just been passed. The following are the new rates of duty on electrical and similar goods, and the old rates have been added for purposes of comparison; it should be particularly noted that the decree re-introduces the differential duties established by the General Tariff in respect of various classes of goods imported over the European land frontier, a distinction which was abrogated by the Russo-German Commercial Treaty; so far as these goods are concerned, the rates of duties established by the General Tariff for imports over the European land frontier are in nearly all cases 20 per cent. higher than the corresponding rates for imports by sea. The Blue Book containing the complete tariff may be purchased from Messrs. Wyman & Sons, Fetter Lane, E.C., at a cost of 7d. Poud = 40 funts = 36 lb.

	Old rate. Roubles.	New rate. Roubles.
Asbestos manufactures in combination with other materials or not	Per poud. 3·50	Per poud 3·85
Moulded carbon wares for electrotechnical purposes such as arc light carbons, plates, cylinders, &c., weighing less than 10 funts each	6	8·80
Weighing 10 funts or more each	1	1·10
Pipes of porous clay and moulded parts of Pipes—		
Unglazed	·10	·11
Glazed	·15	·22
Mineral tar, bituminous mastic all kinds of fusible asphalts	·30	·33
India-rubber (caoutchouc and gutta-percha), prepared and manufactured:—		
1. Soft:—		
(*a*) In sheets, slabs, threads, or dissolved; wares not specially mentioned and not in combination with other materials	Per funt. 0·20	Per funt. 0·22
(*b*) Manufactures not specially mentioned in combination with other materials; rubbered cloth ...	0·30	0·33
2. Hard (vulcanised):—		
(*a*) Unwrought sheets, slabs, sticks, pipes, &c.	0·20	0·22
(*b*) Manufactures not specially mentioned, whether in combination with other materials or not ...	0·50	0·55
3. Boots and shoes of caoutchouc or gutta-percha, combined or not with tissues, leather, buckles, &c.	0·42	0·46⅔
4. Tissues impregnated with india-rubber, for fillets of cards:—		
(*a*) With felt...	0·15	0·16½
(*b*) Without felt	0·30	0·33
	Per poud.	Per poud
Steel rails, even perforated or grooved ...	·99	·99* / 1·18⅔†
Copper, aluminium, nickel, &c., and alloys:—		
In pigs, ingots, shavings, filings, scrap and powder	5	5·50
In bars, rods and sheets, even if polished or with designs rolled or stamped on their surfaces—		
(*a*) Of a thickness of ½ mm. or more	6	6·60
(*b*) Of a thickness of less than ½ down to ⅓ mm. inclusive ...	6·40	7·04
(*c*) Of a thickness of less than ⅓ mm.	7·10	7·81

NOTE.—Sheets of copper cut otherwise than in rectangular form pay the respective duties specified under (2) above together with an additional 10 per cent. The additional 10 per cent., however, does not apply to sheets of other metals and alloys referred to above cut in the same manner. Copper and copper alloys, as well as the other metals and their alloys referred to, if rolled or wire drawn and of a diameter or width of 12½ mm. or less, pay duty as wire.

(To be continued.)

* Imported by sea. † Imported over European land frontier.

CONTROL APPARATUS FOR STEEL MILL AUXILIARY ROLLS.

THE manufacture of steel being essentially a series of processes, immunity from defects in design of the machinery used for any stage in the process, however relatively insignificant its function, is of vital importance.

In no branch of the industry have greater improvements been made during recent years to produce absolute reliability, simplicity,

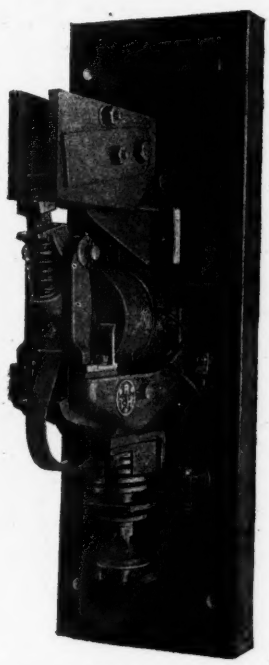


FIG. 1.—CONTACTOR WITH SHUNT OPERATING COIL FITTED WITH MECHANICALLY-INTERLOCKED ACCELERATING RELAY.

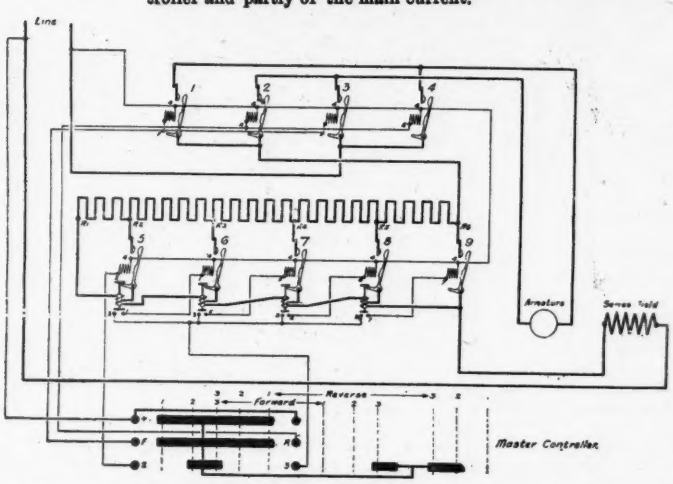


FIG. 2.—CONNECTIONS OF B.T.H. CONTROL PANEL, CONSISTING OF CONTACTORS FITTED WITH MECHANICALLY-INTERLOCKED CURRENT LIMIT ACCELERATING RELAYS.

and greater output, than in the electrical equipments for controlling the reversible motors driving the live rolls.

Control apparatus for this service is subjected to the most severe conditions to which electrical apparatus has been applied for commercial purposes, as the motors driving the rolls have to be started, checked, started again or reversed as often as 20 to 30 times a minute throughout a day of 20 hours.

The controlling device originally used was the well-known hand operated dial type adopted for other industries, consisting of contacts for reversing the armature connections, and introducing or cutting out resistance in series with the motor armature for starting and reversing the main armature current passing through these contacts. The earliest forms, as for other industries, consisted of fixed contacts mounted in one plane on slate or other insulating material over which were moved contacts mounted on or geared to the operating lever. These dial type controllers were at one time superseded by the well-known drum type controller as used for tramcars. The magnetic blow-out can be more conveniently applied to this form of controller, which has the additional advantage that the wear caused by arcing on the moving contacts is less, due to the fact that a different contact is used for

FIG. 3.—B.T.H. MASTER CONTROLLER WITH COVER REMOVED.

each division of resistance, whereas in the dial type the same moving contact is subjected to the arcing of each resistance step.

A drum type of controller, however, becomes very massive when sufficient control points are used to limit the current which flows on the first notch to a low value, and the moving parts become so heavy as to cause fatigue to the operator. For this reason the dial type, which in its later forms was a sound mechanical structure was, in many cases, preferred to the drum type.

No form of hand-operated main current controller yet designed, however, contains the essential features for the satisfactory control of auxiliary rolls.

The usual practice adopted when starting a motor, of delaying movement of the controller handle from step to step until the motor has accelerated, and the current decreased to approximately its steady value, cannot be observed in this service, where the operator's whole attention must be applied to the billet being rolled, and not to the protection of the motor or gears. Some form of automatic protection is therefore necessary, and this must be applied so as not to delay notching an instant after the current has decreased to the required limit for cutting out the next step of resistance. For this reason dashpot control is not suitable.

These considerations lead to the conclusion that the best solution of the problem is obtained by the use of a manually-operated master controller and electrically-operated contactor switches, the contactors closing partly under the influence of the master controller and partly of the main current.

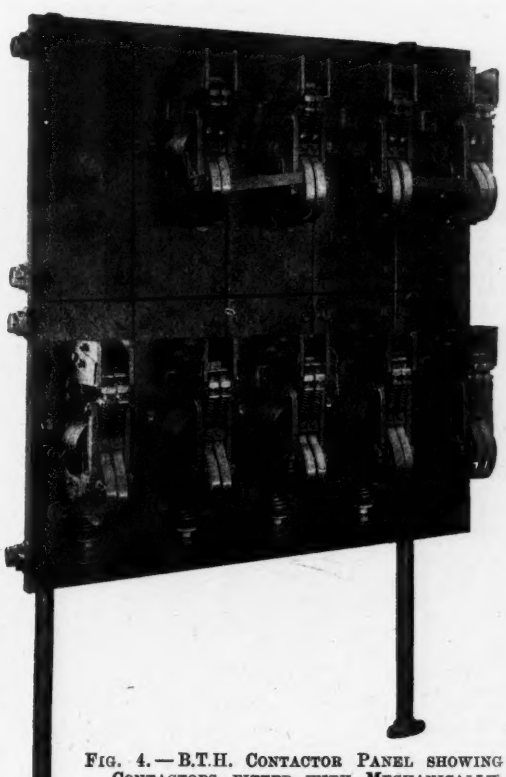


FIG. 4.—B.T.H. CONTACTOR PANEL SHOWING CONTACTORS FITTED WITH MECHANICALLY-INTERLOCKED CURRENT LIMIT ACCELERATING RELAYS.

As the cycle of operations is varying all the time, it is impossible to apply a device for producing entirely automatically the required results, and the human element must necessarily be introduced

This form of controlling device is now being generally adopted for the control of auxiliary rolls. Such a system, to be satisfactory for use in a steel works, must be free from the mass of small wiring and auxiliary contacts usually associated with the earliest forms of automatic devices.

A contactor having the necessary rugged characteristics and simplicity of construction for the service, is found in the type universally adopted for railway service, which has solid main contacts pressed together by strong spiral springs. Fig. 1 shows the type in question for direct-current circuits, which has very few

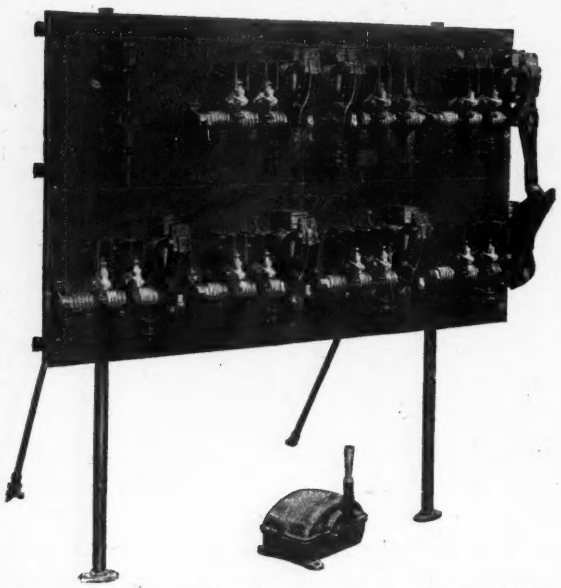


Fig. 5.—B.T.H. Contactor Panel and Master Controller, suitable for use with a Reversible Induction Motor.

parts, all parts being easily accessible for inspection, cleaning and renewals.

The method of making the current limit relay part of the contactor, adopted by the British Thomson-Houston Co., Ltd., of Rugby, who were the first to introduce contactor systems for the control of live roller gear in this country, enables a very simple wiring system to be adopted, as shown in fig. 2, which is a typical diagram for live roll service. Referring to the diagram, contactors 1 and 2 are mechanically interlocked, so that they cannot be closed together; so also are contactors 3 and 4. Each current limit relay consists of a main coil and iron plunger, the plunger carrying a contact disk which bridges two contact posts when in its lower position. The plunger is held mechanically in its upper position by the moving arm of the contactor when the contactor is open, as shown in the view. When the contactor closes, the plunger is mechanically released, and is only held in the upper position by the magnetic effect of the main current. When the main current has decreased to a predetermined value due to the speeding up of the armature, the plunger falls to its lowest position, thus closing the operating coil circuit of the next resistance contractor, which closes, causing the main current to increase and accelerate the motor. This is repeated for each resistance step.

The type of master controller used by the B.T.H. Co. is as shown in fig. 3. This has three control points—forward and

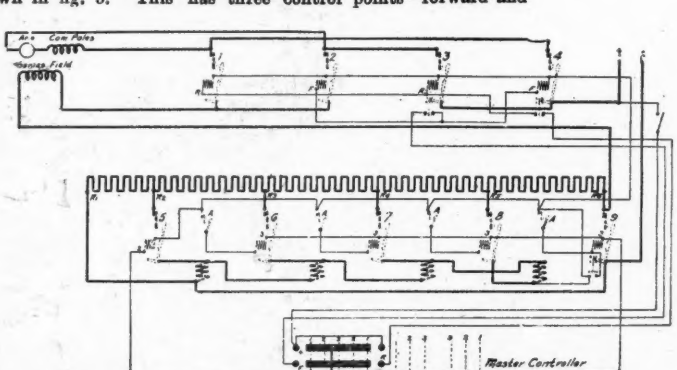


Fig. 6.—Connections of B.T.H. Control Panel, consisting of Contactors and Series Contactor-type Accelerating Relays.

reverse. The first point closes the armature circuit through a very high resistance. This serves as a check point when the controller handle is thrown from forward to reverse. The second point corresponds to slow running of the motor, and is used for turning the billet. When the controller is on the third step the rest of the resistance contactors notch up automatically under the influence of the current limit relays.

The great advantages obtained with the contactor equipments over the hand-operated main controller equipments have been as follows:—

The wear on the motor, shaft and pinions, and the consequent repairs, are greatly reduced, due to the fact that the current limit relays prevent these parts being subjected to excessive stresses. The contactors having a quick make-and-break action, and being fitted with separate blow-out devices, are more suitable for controlling heavy currents without excessive wear than are ordinary controllers, and although better able to deal with heavy currents than the hand-operated controller they are not subjected to such heavy currents, due to the fact that the current is controlled within limits by the relays. The quantity of steel rolled in a given time is increased, as the operator can move the controller handle as rapidly as he likes without fear of breaking pinions or shafts, the motor being automatically accelerated or reversed in the shortest safe time. Another important feature is that these small master controllers can be used by the operator without fatigue.

Fig. 4 shows a typical contactor panel for direct-current circuits, and fig. 5 for alternating-current circuits as made by the B.T.H. Co.

Diagram fig. 6 shows a control equipment for direct-current circuits, for which another form of current limit relay is used, the control system being otherwise the same as described above.

The relays in this case are small series contactors, the main contacts of which are in the control circuit, the operating coils being in the main circuit. These series contactor relays which are shown in fig. 7 are a B.T.H. Co. patent. They have the property that they can be adjusted so that the contacts will remain in the open position if a current of more than a desired value be switched through the operating coil, and will close automatically when the current has decreased to a desired value.

In the diagram, fig. 6, the main contactors which are operated by shunt-wound coils are marked 1-9 inclusive. The contacts of the relays are marked A, the main coils of the relays being shown immediately below the contacts. A main contactor in closing to short-circuit one of the divisions of the starting resistance completes a circuit through the operating coil of the relay controlling the contactor next to close in the sequence. The instantaneous increase in the line current caused by short-circuiting a division of the starting resistance causes the relay contacts to remain open until the motor has accelerated and the line current has decreased to a safe value. The relay then closes completing the circuit to the operating coil of a main contactor, which then closes. The main contactor in closing energises the coil of the next relay, and so on. The control system shown in fig. 6 is being successfully used for rolling mill service.

NOTES FROM CANADA.

[From our Special Correspondent.]

Like other countries, Canada is making strenuous efforts in regard to trade. The Department of Trade and Commerce has already prepared several special bulletins dealing with the trade of Germany and other subjects of interest, and is doing all it can to assist manufacturers, giving them information as to opportunities for trade and other matters.

The Canadian Manufacturers' Association is now similarly exerting itself, and, besides fostering a "Made in Canada" campaign, designed to induce people in this country to buy home-made goods in preference to any others, the Association

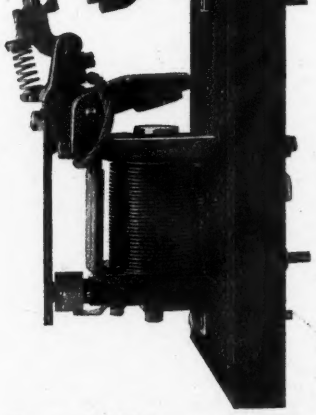


Fig. 7.—B.T.H. Series Contactor.

at a recent meeting discussed the plans of the recently-formed "Export Association of Canada, Limited," which will endeavour to develop the trade of the Dominion with foreign countries.

It was stated that the first duty of this Association would be "to strengthen the trade ties between the various Dominions of the British Empire and to take advantage of the

great opportunities for trade with them, both now and after the war."

The development of trade with Russia, France and Belgium, as well as China and South America, was also spoken of, and it is apparently intended that an office shall be opened in London, which will act as a commission agent for the manufacturers and provide for the transportation of goods.

Some little time ago telephonic communication was established between New York and San Francisco—a few days back it was the turn of Toronto to be put in direct connection with that distant city, and according to the daily papers the voices were perfectly plain and conversation was carried on with ease—a noted singer in "Frisco" entertained the Toronto audience with a song. Montreal has also been put in touch with the Californian city in the same way.

The writer of these notes has on more than one occasion within the last two years or so suggested that it would be a good thing for British engineering trade with this country if facilities could be afforded to young men here to get their engineering training in British workshops instead of going to the U.S.A. for it and becoming, as they inevitably do, to all intents and purposes, American engineers, imbued with the notion that everything worth having is made across the border, and being, of course, entirely ignorant of, and altogether out of touch with, any British products or methods, etc.

This idea is set forth in very similar terms by a writer in the *Engineer* for April 16th, 1915, on page 383. It is to be hoped that some day a little notice will be taken of the suggestion, as the arguments in its favour are undoubtedly based on solid facts.

Mr. Hamilton Wickes is quite right when he urges British manufacturers to make greater efforts to secure Canadian trade—if they wish to have any at all. In the writer's own experience it is much easier to get information from the great country to the south than to write home, wait a long time, and then perhaps have one's inquiries for prices answered with no information as to whether the figures given are f.o.r. factory, f.o.b. British port, Canadian duty paid, or any such important details. Such a state of affairs is not exaggerated at all.

The B.E.A.M.A. and similar bodies might do worse than take measures not only to impress upon their members the necessity for giving certain important details when quoting, but also, as far as possible, supply the information or state how and where it may be obtained. Perhaps they already do this, but, if so, the members must, many of them, be sadly neglectful of such advice.

Very few firms, except those who actually have their own men out here, ever take the trouble to quote their goods f.o.b. a Canadian town or city, even when specially asked to do so. If the necessary information is not available at home, steps should be taken to make it so somehow or other.

There is no doubt about it, and nothing is likely to change the situation, that the consulting engineer or other individual who requires prices and other particulars will invariably make use of those which are furnished in the handiest form and leave the others aside if he can possibly arrange his work with any degree of satisfaction in this way.

WAR ITEMS.

German Engineering during the War.—At a recent meeting of the Association of German Engine Builders, Herr Fr. Frölich discussed the position of German engineering during the war. While admitting that there had been a considerable falling-off in the number of new contracts, he claimed that the machine-tool and agricultural-implement makers had more than enough work on hand. As many branches of industry (Herr Frölich thinks) are likely to be extremely busy as soon as peace is restored, he suggested that the works should prepare themselves for the coming boom (!) by extending their plant and by making other necessary alterations. It was probable that after the war there would be less preference shown in Germany for foreign machine tools, typewriters, sewing and shoe-making machines, and agricultural implements, and now was the time to start systematic preparation to supplant such machines. Herr Frölich referred in ecstatic tones to the achievements of the German engineering industry in meeting the enormous demands of the Army for munitions. Deliveries were being expedited, and the system of employing middlemen in contracts, which in the beginning of the war adversely affected the efficiency of the engineering supplies, had been abolished. While the home trade had been supported by the war, export trade had suffered considerably, and this was particularly important, because normally about one-third of the total output of German engineering works was exported. Herr Frölich gave reasons for believing that after the war the German engineering works would be able to resume unweakened their competition in the world's markets with their old opponents, provided the Government took measures to safeguard Germany's interests abroad. Otherwise, "the coming military victory" might be accompanied by heavy economic losses.—"The Ironmonger."

Scheme for Training Munition Workers.—The Engineering Department of King's College, London, is organising a scheme for training unskilled and semi-skilled men in the use of tools, so as to fit them for work at the munition factories. The work is to begin at once, and will proceed throughout the summer vacation, and, if the need is still great, will be continued during the winter. The Industrial Reserve, 227, Strand, is helping the College both in the supply of men who can be usefully trained for such work, and in finding places for them in factories when trained. The work will be done in two shifts, from 9—12.30 and 1.30 to 5 p.m., Monday to Friday inclusive, so that forty men can be taken each day. The average course is expected to last for three or four weeks, though this will naturally depend on the previous training and progress of the student. The fee charged will be the nominal one of 2s. 6d. per week, which will only go a small way towards defraying the running expenses of the scheme. £150 has already been contributed by a subscriber to the Industrial Reserve, and it is hoped that further contributions will follow. There is no doubt that such a scheme, which has already been initiated at Sheffield, Birmingham and Manchester, will be of the utmost use in making available for the public service a great amount of willing help which is at the present moment unfocused and untrained. The College and the Industrial Reserve are already in touch with firms manufacturing munitions, and there should be no difficulty in finding places for sufficiently qualified men. This scheme, as well as the advanced testing work which the department will be able to do for the Ministry of Munitions, will be under the direction of Professor A. H. Jameson. Inquiries and applications should be made to the Secretary, King's College, Strand, W.C.

The Manchester School of Technology has similarly arranged with the local Munitions Committee to provide classes in the workshops of the School for preliminary training. The Nottingham Society of Engineers is holding a special meeting on Monday evening next, at which the Munitions Committee will be represented, to discuss the best way in which the Society can assist the Committee.

500 Iron Crosses for the A.E.G. Men.—The activity of the Berlin A.E.G. in the financial year which ends in July is reported to have been divided into two parts. In the first place there are the Army orders, which were very considerable, but the profits on which had been over-estimated. Secondly, there are the regular electrical contracts, which are declared to have been normal, both in the inland market and for export to neutral countries. Taken as a whole, the turnover has been very satisfactory. For the rest, the exports in general have been interrupted by the war, but no doubt is entertained that, after the return of peaceful times, the former relations will be re-established quickly in some cases and less rapidly in others, owing to the splendid organisation and the indispensability of the manufacturers of the German electrical industry. Equal confidence is entertained by industries in general in regard to the future. For the moment it is stated that nothing can be said concerning the dividend for the past year, but the liquid state of the company's finances, which has always been made a prominent feature, is particularly great at present, and the company also holds War Loan securities of the value of £600,000. About 18,000 employés are in the field, where 450 have fallen, and as many as 500 have received the Iron Cross. It is calculated that the voluntary war grants made to dependents of workmen called up for active service will soon reach £250,000.

Employment of Disabled Sailors and Soldiers.—With reference to the announcement in our last issue to the effect that the Council of the Institution of Electrical Engineers desire to call attention to the demand for employment from disabled sailors and soldiers, we understand that the Committee which deals with the question of the employment of these men is the Association for the Employment of ex-Soldiers, 119, Victoria Street, Westminster, London, S.W., to whom all applications for further information and for lists of the local branches of the Association should be addressed. Many of the men could, no doubt, after some training do useful work as switchboard attendants. Attention is also drawn to the report of the Local Government Board Committee upon the provision of employment for sailors and soldiers disabled in the war, copies of which can be obtained from any bookseller, at the price of 1½d. each.

Australia.—A Sydney firm wishes to add British agencies for lampholders and electrical accessories. Reference, 31,674h.

An Adelaide firm wants British agencies for piping, air lift pumps and electric motors. Reference, 31,639f.

A Melbourne firm wants names of British makers of hardware, tools and electrical goods. Reference, 31,639q.

A Melbourne agent wants to hear from British makers of electric cranes, wires, cables and pumps. Reference, 31,639.

Inquiries respecting any of the foregoing should be addressed to the Board of Trade Commercial Intelligence Branch, London.

Board of Trade Inquiries.—The June 21st list (No. 26) of inquiries received for sources of supply of goods includes the following:—

Clocks for electrical trade signs and other electrical purposes.
Permanent magnets.
Wood or ebonite separators for portable batteries.

Personal and Roll of Honour.—Matters of personal interest arising out of the war will be found to-day and in future under our General Personal Section on a later page.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Railway Carriage Problem.

I strongly concur with your excellent leader on the carriage problem—you have got right down to the root of the evil undermining our commercial system in holding the railway companies responsible for exploiting trade, and bleeding commerce in this country at every possible turn. I may say I have heard from absolutely reliable authority of an instance where a consignment of printers' blocks was dispatched from the Midlands to Plymouth, and the charge for carriage on the same was more than the actual value of the goods themselves, leaving a small loss on the transaction. The same blocks from any town on the Rhine in Germany would have been delivered at Plymouth for considerably less than a third of the English railway charge. If this does not constitute a great scandal to traders in this country, I should like to know what does?

Henry L. Dobson.

Levenshulme, Manchester, *June 22nd*, 1915.

Pitting of Generator Brushes.

Some time ago I had occasion to work on a 500-KW. turbine set which was giving commutator trouble similar to the set mentioned by Mr. Johnstone. The + brushes were also the ones to suffer most, perhaps due to leakages in the circuit somewhere or other in the — side, and thus overloading the live side of the machine. I should take a potential test in the first place and start from the generator brushes, gradually working away.

I cured my set by undercutting the micas between the segments of the commutator to a depth of about $\frac{1}{16}$ of an inch, after which I changed the hard carbon brushes for a better class of the graphite type, which have a carrying capacity double that of hard carbon. On full load I adjusted the brush rocker wheel until I obtained sparkless commutation.

Mr. Johnstone will perhaps pardon me if I differ from him in saying that his set is not sparking badly under the brushes. It is the minute crackling sparks which eat away the centre portion of the brush face, and are hard to see unless looking end on the brush during the latter part of a big run. If the machine were not sparking, the brush would polish up like glass, and the commutator take on a clear purple tint; it is then in perfect condition and should not be messed with, except for renewing brushes or grinding down. I could give Mr. Johnstone a diagram of the tool and guide for cutting out the micas if he intends setting about the machine. The Morgan Crucible Co., Battersea, would supply him with the proper brushes.

Henry Fowler.

Liverpool, *June 28th*, 1915.

Colonial Advice to Our Advertisers.

I should like to call the attention of the advertisers in your paper to the difficulties experienced by engineers in the Colonies in obtaining particulars of the articles advertised and illustrated in your paper.

Having been a central-station engineer at home for some years before coming out to this colony, I notice very much the difference between home and Colonial undertakings with regard to obtaining up-to-date and new appliances and apparatus, and the chief complaint, if such it can be called, is that with a few prominent exceptions most of your advertisers neglect to mention the names of their Colonial and foreign agents in their advertisements, and even in pamphlets sent through the post.

I often see an illustration and advertisement of a piece of apparatus which is apparently what I am in want of, but it is seldom if ever that any price or even an approximate idea of the cost is given, and my only course is to write home to our London agents, putting them to the trouble of obtaining information and prices which particulars eventually reach me from six to eight weeks' after the inquiry has been made. At the end of this time I may find that the apparatus is not exactly what I require, and I am, therefore, again six to eight weeks away from obtaining what I want, or if it does happen to be the article, I have again to write back, and a further three weeks is lost before the order reaches London, whereas if advertisers would give some approximation to the cost and the names and addresses of their principal Colonial or foreign agents, inquiries could be made quickly and expeditiously in the country, to the advantage both of the buyer and of the manufacturer.

This is a matter which evidently does not appeal to the average manufacturer, simply because he has never placed himself in the position of the Colonial buyer, and I venture to say that the additional advertising space required, if any, for lists of the principal agents, would well repay the outlay.

By giving assistance to this object of putting the home manufacturers in closer and quicker touch with Colonial and foreign buyers through their agents in the respective countries, you will, I feel sure, be conferring a benefit on manufacturers and buyers alike.

B. Sankey,
Municipal Electrical Engineer.

Port Elizabeth, South Africa, *June 10th*, 1915.

BUSINESS NOTES.

Consular Notes.—CHOSEN.—The American Consul at Seoul reports that information to hand from Kongju, the capital of South Chusei Province, says that a 50-H.P. electric light plant is to be established there to supply, approximately, 1,500 lamps. The initial capital of the company is $12,500. It is anticipated that the machinery will be ordered from Japan, although no definite decision has been reached as yet as to the type to be employed. Correspondence should be addressed to the Kongju Electric Co., Kongju, South Chusei Province, Chosen.

CUBA.—Senores Maristany and Estrada have been granted permission by the Cuban Government to install an electric light plant at Campo Florida, Habana Province; Senores Pollo and Herrara have been authorised to install a similar plant at Coliseo, Matanzas Province, and Senor Cuesta has been authorised to install a similar plant at Arrogos de Mantua Penar del Rio Province. In each case, it is specified that the concession will be void if the plant is not in working order within one year.

FRANCE.—A recent American Consular report on the trade of France contains some interesting information regarding the electrical industry before and since the war. According to this report the general conditions prevailing in the electrical industries of France in 1914 up to August 1st were not unfavourable. Although a tendency to weakness had set in during the latter part of the first half of the year, the orders received equalled those taken during the first six months of 1913. Immediately after war began business came to a standstill. It soon revived, however, and the year ended with a smaller volume of trade than in 1913, but all the factories were in active operation with curtailed capacity. It is estimated that in 1914 the orders for heavy electrical machinery fell off by about 30 per cent., for transformers about 20 per cent., for traction apparatus about 60 per cent., for general lines of electrical goods about 20 per cent., and for turbines about 50 per cent. There was also a considerable reduction in the sales of cables, practically no orders for apparatus for the extraction of nitrogen from the air, and but few for ozonization of water. Trade in electric cooking and heating apparatus has never been of great importance in the country, owing to the high cost of electrical energy, there being no special rates for current applied to heating and cooking.

There were much smaller orders placed in 1914 with French manufacturers for the equipment of overland central power stations than during the previous year (which was an exceptional one for this branch of the industry), as few new stations were established and none of great importance. The business of the existing plants, which had been expanding during the first six months of the year, fell off considerably in the second half, owing to the abnormal conditions prevailing.

None of the leading French railway companies contracted for new electrification of their roads in 1914. The work on the suburban lines of the Western Railway which had been commenced is still progressing, and the Southern Co. (Midi) has ordered additional electric locomotives for use on its lines from Tarbes to Paris and from Villefranche to Perpignan, where already three electric locomotives and a number of motor cars had been placed in service.

There was a notable increase in the manufacture of metal-filament lamps in France in the early part of 1914, so that, notwithstanding the falling off during the second half of the year, the total annual production was about 30 per cent. in excess of that of 1913. The change from carbon to metal-filament lamps being practically completed, a reduction in the rate of increase in their manufacture during 1915 is expected, even if business conditions are normal. Owing to keen competition existing, the lamp prices quoted during the first six months of 1914 were very low, but toward the end of the year, in consequence of the decreased production caused by the scarcity of labour and material, the prices became more favourable, the increase ranging from 20 to 30 per cent. Generally speaking, there was a tendency to lower prices for other electrical products owing to the keen foreign competition, especially with German and Swiss goods. An exception might be made as regards motors employed in steel work, for which there was a large demand. Many of the companies, taking advantage of the slackness of trade, re-equipped and modernised their plants. As with lamps, scarcity of material and labour and the suppression of an important part of the competition, has resulted in raising prices to a better level. In the last annual report from the Consulate-General, attention was called to the appearance of high capacity 1,000 to 3,000-C.P. half-watt tungsten lamps. Such lamps are now being made of small capacities, which allow them to be adopted for domestic lighting; 50-C.P. lamps are being sold for normal voltage, *i.e.*, 100 to 250 volts. The half-watt lamps for lower voltages are rendering efficient service when used as automobile headlights, battery flashlights for army use, &c. The fact that soon the manufacturers will be able to obtain 25-C.P. lamps that consume 1 half-watt per C.P. will result in a reduction in the cost of electric lighting. Water sterilisers, the sterilising being accomplished through ultra violet rays given by mercury vapour quartz electric lamps, are being successfully used for army field sterilising outfits and in military hospitals, thereby providing sterile water for soldiers in service on the field and for nurses and wounded in hospital. The hydro-electric development, which has temporarily been brought to a standstill owing to the war, will, after the hostilities are terminated, be taken up with renewed activity, and in this branch there should be a good market for electrical machinery, the greater part of which was previously imported from Germany.

Most factories in France that were previously used for the manufacture of electrical apparatus are now being employed in the manufacture of ammunition, &c., for the army, with the result that there is now a good opportunity for the importation of all classes of electrical goods into this country, especially electric motors of capacities up to 50 H.P.

China.—In a report by H.M. Consul-General at Yunnan-fu on the trade of Mengtsu, shortly to be issued, it is stated that the great drawback to British trade in the Province of Mengtsu hitherto has been the lack of any British firm to represent United Kingdom manufacturers and push the sale of their goods; but there is a good prospect of this deficiency being remedied in the near future. The present time is exceptionally favourable for such an enterprise, as the two German firms which have hitherto supplied local buyers with machinery, piece-goods, dyes, paper, &c., can now obtain no further supplies, and the Chinese would welcome the establishment of a British firm in Mengtsu. There are inquiries for irrigation pumps, electric light machinery, flour and rice mills, material for the installation of water-works in Yunnan-fu, locomotives and trucks for the Pishihchai Railway, and other items, but these can only be dealt with by a man on the spot who is prepared to make a contract for the goods delivered c.i.f. at Haiphong, possibly assist to some extent in their erection, and arrange the question of exchange. The representative of the machinery department of a Hong-Kong firm is now in the Province looking into these matters, and there is a good prospect of at least some of the inquiries resulting in the placing of orders with United Kingdom manufacturers.—*Board of Trade Journal.*

France.—Inquiry is made for the names of United Kingdom manufacturers of mechanical ploughs, reaping machines and harrows (worked by gas and petrol engines, steam or electricity), also motors (of 2 to 12 H.P.) suitable for agricultural use. (Reference G.W. 1,256.) Communications to the Secretary, British Chamber of Commerce, 9, Rue des Pyramides, Paris.

Private Arrangements.—JOHN BOULT & J. H. BOULT (trading as John Boult), cycle agent and electrical engineer, 3, Grosvenor Street, Chester.—A meeting of the creditors herein was held at the Westminster Hotel, Chester, last week, when Mr. Dodds, solicitor acting for the debtor, stated that the liabilities amounted to £631, and the assets were estimated to produce £692, while there were preferential claims to be deducted amounting to £10. It was reported that the business had been carried on in partnership by the debtors since May, 1912, each partner having put in about £100 cash. John Boult was stated to have had no hand in the management of the business, this having been left to J. H. Boult, his cousin. John Boult was said to have a separate business at Liverpool, which was carried on in his own name, and in connection with which no partnership existed. It was decided that a deed of assignment of the assets of the Chester business only be executed in favour of Mr. C. Turner, of Sheffield, as trustee, with a Committee of inspection consisting of the General Electric Co., Mr. A. Cripwell, and Mr. Parkin S. Booth. The following are creditors:—

Drake & Gorham, Ltd.	£101	B.I. & Helsby Cables, Ltd. ..	£24
General Electric Co.	43	Tucker, J. H., & Co.	21
Fuller Accumulator Co... ..	38	Macintosh, C., & Co.	14
Glover, W. T., & Co.	36	Ward & Goldstone..	16
Baxendale Bros.	33	Wilson, J. J.	13
Sloan Electrical Co.	34	Ferranti, Ltd.	12
Edison & Swan	33	Credenda Conduits	13

Bankruptcy Proceedings.—J. W. & T. W. TATTERSALL (Tattersall & Tattersall), electrical engineers, Willesden Lane, N.W.—Last day for proofs for dividend, July 10th. Trustee: Mr. E. S. Grey, Official Receiver, Bankruptcy Buildings, W.C.

Dissolutions and Liquidations.—FELGATE INSTALLATION CO., LTD.—Creditors must send particulars of debts, &c., to Mr. A. G. West, 51, Market Place, Reading, the liquidator, by August 5th.

PILLINGS & Co., builders and electricians, 13, Cross Street, St. Leonards-on-Sea.—Messrs. F. Pillings and R. E. Saggie have dissolved partnership. Mr. Pillings will attend to debts, and continue the business.

Australian Trade.—A correspondent who is representing in London a firm of engineers and contractors which has been established in Australia for 30 years, and has branches in each State and workshops at Sydney, equipped with modern tools and appliances, is open to receive proposals relating to the manufacture in Australia, under licence, of approved specialities and to arrange fresh agencies and purchase new lines in engineers' requisites. Communications addressed to "Sydney Agent," care of the Editors, will be forwarded.

New "Mazda" Half-Watt Lamps.—The BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, London, E.C., have issued an eight-page illustrated pamphlet concerning "Mazda" half-watt lamps, giving particulars of new sizes, ½ and 1 ampere, and information as to reduced prices. The new lamps are made for 25, 50—60, 100—130, and 200—255 volts.

Trade Announcement.—MR. L. H. EULER, A.M.I.E.E., has changed his address from Broad Street Buildings, E.C., to 46, Roan Street, Greenwich, S.E. Telephone, New Cross 463.

Advance in Prices.—THE BASTIAN METER CO., LTD., have announced an advance of 20 per cent. in prices of Bastian meters from July 1st, consequent upon increased cost of raw material and labour.

Book Notices.—*Alignment Charts.* By E. S. Andrews. London: Chapman & Hall, Ltd. Price 1s. 3d. net.—In this booklet the author explains the method of constructing and using the alignment charts which have come into common use in recent years, and which are capable of effecting a great economy of time and labour. In these charts the desired result is arrived at by laying a straight-edge or stretching a thread across two graduated parallels representing two of the variable quantities, and reading off the third quantity at the intersection of the straight-edge with a third graduated line. This process corresponds to the solution of a linear equation of the first order between three variables, any two of which are given; the author gives a simple proof of the validity of construction, and shows how it can be applied to simple formulæ. When the formula involves the products of the terms, it is put into logarithmic form, and then can be dealt with in a similar way, the parallels being graduated logarithmically. When there are more than three variables, the solution is obtained in two stages, and the principle may similarly be extended to any number of variables. The method is of great value, and the author's explanations are clear and concise.

"Trade Products of the British Empire" is the subject covered in a special supplement issued with the July number of the *Chamber of Commerce Journal.* It is a statistical account of the resources of the British Empire as a supplier of foodstuffs and of raw materials for British industries, with statistics and notes as to foreign sources of supply. The prevailing conditions render such an account of exceptional interest just now.

We have just received the issue of Messrs. W. T. Glover & Co.'s Almanac for 1915-16. This annual has now reached its 14th year, and differs from all other publications of the kind in being issued at Midsummer; this, however, is only one of its many unique features. It stands alone in that every day in the year receives special attention in the shape of a device, a useful extract from some technical treatise, an interesting view of one of Glover's cable installations, or a humorous item in the shape of a sketch or a clever literary composition. The only fault that we have to find with it is that the temptation to "look ahead" is apt to prevail over the more pressing demands upon our time; but that is really a subjective not an objective fault, arising out of the high quality of the contents. The leaflet for July 1st shows the well-known trade-mark of the company, and indicates that the firm was established as long ago as 1868.

"Tramway Track Construction and Maintenance." By R. Beckerstaffe Holt. London: *Tramway and Railway World* Offices. Price 10s. 6d.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 6. June, 1915. Washington: The Institute. Price $1.

"Science Abstracts." Vol. 18; part 6. June 25th. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each section.

"An Improved Governor for Water-Turbines." By Percy H. Pitman. Excerpt from the *Proceedings* of the Institution of Mechanical Engineers.

"Shall the Government Own and Operate the Railroads, the Telegraph and Telephone Systems? Shall the Municipalities Own their Utilities?—The Negative Side." Six addresses. New York: The National Civic Federation. Price 50 cents.

"Alternating Current Work." By W. Perren Maycock. London: Whittaker & Co. Price 6s. net.

Railway Station Lighting.—The Caledonian Railway Co.'s central station at Glasgow, which was originally lighted by 120 10-ampere open-type arc lamps with opalescent globes, running four in series on 230 volts, mounted at a height of about 22 ft., and spaced from 60 to 80 ft. apart, is now lighted by 500-watt Osram "Atmos" type lamps, which occupy the positions previously occupied by the arc lamps. The result has been very satisfactory, as there is a reduction of 300 watts on each circuit of four lamps, while the illumination of the station has been increased and considerably improved. The horizontal illumination in the main hall of concourse is 2 foot-candles maximum, with a minimum of 1·7 foot-candles, while along the platforms the variation is between 0·8 and 1·6 foot-candles.

For Sale.—The Ely Valley Lighting Co., Ltd., of Cardiff, have for disposal the following plant:—Locomotive multitubular boiler; 75-KW. and 150-KW. generating sets; three-panel switchboard; oil-cooled transformers. Particulars are given in our advertisement pages.

LIGHTING and POWER NOTES.

Barnet.—WORKHOUSE LIGHTING.—The B. of G. has referred the whole question of electricity supply to a small Committee with power to take the advice of a firm of consulting electrical engineers with regard to the condition of the present plant, and the probability of its expansion, also as to whether it would not be better to take the whole supply from an outside source.

Bexhill.—YEAR'S WORKING.—In his report on the Corporation's electric light undertaking for the year ended March 31st, 1915, the Borough Accountant states that the gross profit amounted to £6,218, as against £6,524 in 1914; after meeting debt charges, costs of meters, public lighting, depreciation, &c., a sum of £2,128 is carried forward, as against £1,817 brought into the accounts. A total sum of £1,472 has been credited to depreciation.

Bentham.—E.L. SCHEME.—Mr. Best, promoter of an E.L. scheme for Bentham, has written to the Settle R.D.C. relative to the Council's refusal to allow poles to be erected on the highway from Low Bentham to High Bentham, for overhead wires. He points out that unless the poles are allowed to be erected it will be impossible to supply current to High Bentham. At his suggestion a Committee has been appointed to meet a deputation from the Electric Supply Co. with a view to underground cables being laid for only a short distance along the route.

Blackpool.—YEAR'S WORKING.—The annual accounts of the electricity department show a total revenue of £47,326, a gross profit of £23,260, and a net balance, after meeting financial charges, of £8,499 (about £1,000 better than the previous year), which was disposed of as to £5,000 to general district fund, and £3,499 to reserve. The latter fund was drawn on for over £5,000 during the year, and has a balance of £8,093 in hand. In all, 5,842,433 units were generated, as against 5,410,377 in the previous year.

Bolton.—YEAR'S WORKING.—The report of the electricity department shows that 13,688,272 units were sold last year, including 7,367,698 for power, and 4,500,000 for tramways. The working cost amounted to ·645d., and the inclusive cost to 1·137d. per unit, while the maximum load was 5,557 KW., or about 900 KW. less than in 1914. The total connections in KW. amounted to 19,452, an average of 4·9 KW. per consumer, and included 1,546 motors of 16,641 H.P. used by 620 consumers. The gross profit on the year was £29,916, as against £30,301 in 1914, and after meeting financial charges and capital contributions, a surplus of £145 remained.

Bradford.—YEAR'S WORKING.—At a meeting of the Electricity Committee, held last Friday, the city treasurer presented the annual financial statement relating to the electricity undertaking, which shows that the profit for the year was £18,955, as compared with £14,905 in the preceding year, an increase of £4,050. The sale of electric current yielded an income of £138,000 (£3,500 in excess of the previous year), generation costs amounted to £39,700 (an increase of £7,000), and the cost of distribution had increased by £850 to £6,340. The gross profit on the undertaking was £500 in excess of that of the previous year; £22,900 (£1,000 more) was absorbed in payment of interest on loans and income-tax), whilst £33,000 had gone in sinking fund charges, this being £4,000 less, in consequence of the decision of the Finance Committee of the Council to apply the principle of accumulating sinking funds in respect of the various undertakings of the municipality.

Bridlington.—YEAR'S WORKING.—The report of the Corporation's electrical undertaking for the past year, shows the effect of the war, which has resulted in an enormous reduction in lighting in this coast resort. The revenue amounted to £7,606, and the gross profit to £3,764, leaving a deficit, after meeting loan charges, &c., of £314, as against a net profit of £1,373 in the previous year. The balance of profit at March 31st, 1914, stood at £3,057.

Canada.—The City Council of Vancouver, B.C., is investigating for itself the water power possibilities of several sites in the vicinity with a view of establishing a municipal light and power plant. One of these sites is located on the Cheakamus River, 16 miles north of Squamish, the second on the Indian River at the head of the North Arm of Burrard Inlet, and the third on the Bridge River, 10 miles west of Lillooet.

The B.C. Power and Electrical Co. holds the rights on the Cheakamus River, capable of producing 100,000 H.P. The minimum cost of generating and transmitting to Vancouver is estimated at $52 per H.P. and the maximum $80 per H.P., depending on the form of construction.

It is claimed that power can be generated for three-tenths of a cent. per KW.-hour. The maximum cost of the construction of the plant is estimated at about $3,900,000.

The one on Indian River is 25 miles from the city and is capable of developing at a single power house 40,000 H.P. It is claimed that this could be easily increased to 50,000 H.P. Additional power may be developed by building a second power house four miles further up the river. This development could be made at a cost of $60 per H.P. at the power house switchboard, or $80 per H.P. at the receiving station in the vicinity of Vancouver.

The other power site is approximately 150 miles from Vancouver at Seaton Lake. There 200,000 H.P. may be developed, and by additional storage this amount could be increased to 400,000 H.P. The cost at the power-house switchboard is estimated at $35 per H.P. and $65 per H.P. in Vancouver.

At the request of the Council, the supervising city engineer is preparing a report on the power possibilities of Seymour and Capilano Creeks.

The 11th unit, completing the plant of the Electrical Development Co. at Niagara Falls, has been installed. The full capacity is now 147,000 H.P., but the maximum generating capacity by charter is 125,000 H.P., the additional plant being spare. Four 13,000-H.P. and seven 15,000-H.P. units are installed, consisting of Morris turbines and Canadian G.E. generators.—*Canadian Engineer.*

Continental.—SPAIN.—A concession has been granted for the establishment of a plant to utilise the water power of the River Mero near Combres (Province of Coruna), in the generation of electrical energy for power purposes.

In the annual report for last year of the Sociedad Altos Hornos de Vizcaya, of Bilboa, the largest metallurgical undertaking in Spain, it is announced that at the Sestao Works of the company, large, medium and small rolling mills are now electrically driven, an electricity generating plant comprising two steam turbines and alternators of a capacity of 3,500 KW. having been installed. It is also intended to convert the sheet and plate-rolling mills to electric driving.

ITALY.—According to the *Daily Chronicle*, the Italian troops have destroyed the hydro-electric station at Tonale, on the shore of Lake Garda, and thus deprived Riva di Trento and the Austrian villages on the lake of electric light and power.

Darlington.—L.G.B. INQUIRY.—An inquiry was held on June 23rd, relative to the Council's application for sanction to borrow £34,950 for electricity purposes.

Dewsbury.—PRICE INCREASE.—The Electricity Committee has found it necessary, on account of the increased price of coal, to increase the price of electricity as and from July 1st next, to lighting consumers by 10 per cent.; to rateable value consumers by 12½ per cent.; and to heating and motive power consumers by 15 per cent. The increases will continue in force until December 31st next.

Dublin.—Mr. Ruddle, city electrical engineer, has reported to the Electricity Committee agreeing with the city treasurer's statement that the credit balance on capital account for loans now stands at £40,084. There is available for short extensions, house services and meters, £6,500, or, including cables in stock and paid for, £9,500, which will only last until the end of the year with great care. The only other sums available are £7,997, ear-marked for supplemental work on cables and sub-stations in the city area, and £9,200 for North Lotts and Island Bridge. Mr. Ruddle advised that applications be not encouraged from which no reasonable profit can be made on the capital expended.

Gillingham (Kent).—SCHOOL LIGHTING.—The Education Committee has decided to invite the managers of the Wesleyan Day Schools to apply to the Board of Education for its opinion as to having the E.L. installed in non-provided schools, the T.C. bearing the cost of the installation, and charging the Committee with a sum that will cover the cost of current, hire of fittings, and the installation.

Glasgow.—An arrangement has been come to between the Tramways and the Electricity Committees of the T.C., by which the latter has been granted sanction to take the tramway depôt buildings and ground in David Street, for the purpose of a sub-station.

Glossop.—The T.C. has received intimation that as a result of the Corporation's opposition, the Stalybridge Joint Tramways and Electricity Board has abandoned the proposal to seek powers to acquire the undertaking of the Glossop Urban District Supply Co., and to supply current in the borough.

Haworth.—The U.D.C. has decided to withdraw its petition against the Keighley Electric Lighting (Extension) Provisional Order.

Hornsey.—The T.C. has been informed that in accordance with the terms of the order obtained in 1912 arrangements have been made for the Tottenham District Light, Heat and Power Co. to take over the supplying of electricity to St. Andrew's Church and other premises in Alexandra Park Road, Wood Green. The L.G.B. has sanctioned the raising of an additional £2,000 for the extension of mains. This is a part of a £6,000 loan to which it gave assent before the war broke out.

Huddersfield.—PRICE INCREASE.—The Corporation has given notice of an increase in the price of electricity to all consumers by 12½ per cent.

Leeds.—YEAR'S WORKING.—The units sold for all purposes by the electricity department last year amounted to 43,145,978 as against 31,011,268 in the previous year, an increase of 39 per cent. The total number of consumers is now 14,121. As regards lighting revenue the annual report points out that this is even now £3,065 less than it was in 1907-8, although the number of lighting consumers has grown from 5,504 to 10,759; however, during the year the private lighting output increased by 11 per cent. to 6,429,271 units; power units to 21,728,063 and heating units to 440,161, a combined increase of 16 per cent.; while tramways supply reached 13,823,011 units, an increase of 159 per cent. Street lighting units, as might be expected, fell by 19 per cent. to 678,370 units. The aggregate H.P. of motors in use by consumers was 31,114; and KW. of heating apparatus in use, 1,494 (as against 966). The annual revenue for different classes of load is interesting:—For private lighting, 17·88 units were sold per 35-watt lamp, bringing in 4s. 4d.; for public lighting, 75 units, bringing in 6s. 3d.; for motors per H.P. installed, 698 units, bringing in £2 6s. 7d.; and for heating per KW. installed, 295 units, bringing in £1 3s. 6d. Despite increased working and financial charges, the increased output resulted in a fall in average costs, coal being ·18d. as against ·19d.; total works costs ·38d. against ·42d.; all-in cost (including contribution to capital expenditure, ·07d.) amounting to ·88d. against 1·01d. per unit. The total receipts were £170,031, and the gross profit, £103,606; after meeting financial charges including £12,053 capital expenditure, the surplus was £12,171. On 26,600 KW. of plant installed the net amount of capital debt outstanding amounts to, roughly

£35 per KW. The capital expenditure is divided up as to 37·6 per cent., generating station; 57·4 per cent., mains, transformers, meters, &c., and the remainder for Roundhay undertaking purchase, capital discounts, &c. The maximum load reached 16,460 KW.; the plant capacity was increased by a 7,500-KW. turbo-generator, and decreased by the sale of 3,840 KW. of obsolete plant.

London.—HAMPSTEAD.—The accounts of the electricity undertaking for the year ended March 31st show a net surplus of £2,766, as compared with £6,257 in the previous year; the net income was £69,724, as against £71,887, a decrease of £2,163; the units sold in 1914 were 5,872,308, and in 1915, 5,550,078.

FULHAM.—The Electricity Committee report that the accounts of the electricity undertaking for the year ended March 31st last, show an excess of income over expenditure of £3,262, as compared with £5,321 for the previous year. This surplus is after debiting the revenue account with approximately £2,500 for new house services and meters installed during the year, which was formerly a capital charge. The total available surplus on the account is £6,673, and the Committee recommends that £3,000 be transferred to machinery maintenance reserve account, and £3,673, the balance, be retained on current account.

WESTMINSTER.—The Guardians have been recommended to continue, for a further period of 12 months, the agreement with the Dowsing Radiant Heat Co., Ltd., for the hire of radiant heat plant, at a cost of £12 12s. per annum. This charge includes the upkeep of the plant, but the electricity is supplied by the plant of the infirmary.

ST. PANCRAS.—Some correspondence has taken place with the L.C.C. in regard to the loan for four new boilers, £22,530, which was sanctioned recently. In view of the necessity of restricting expenditure, the contractors are to be approached with a view to postponing for the present the completion of the last two boilers, and thus meeting the wishes of the County Council.

Manchester.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £432,470 for the purpose of the new electricity generating station at Barton.

Mansfield.—LOAN SANCTION, &C.—The T.C. has received sanction to a loan of £2,000 for plant needed to supply current to the military camp near the town, and the B. of T. has sanctioned the use of overhead lines for the supply. The T.C. has decided to advance all charges for current by 10 per cent. from July 1st.

Mansfield Woodhouse.—RESTRICTED LIGHTING.—The U.D.C. having decided, under existing conditions, to have none of the public electric lamps lighted during May, June, July and August, has applied to the Mansfield T.C., who supply current, for an allowance in the account. The request has not been entertained.

Newton Abbot.—RESTRICTED LIGHTING.—On account of restricted lighting, the Urban Electric Supply Co., Ltd., has reduced the public lighting account of the U.D.C. by £200 for the present year.

The company has informed the B. of G. that the charges for current will be raised by 16 per cent. from July 10th.

Reigate.—PROPOSED LOAN.—A L.G.B. inquiry was held on June 21st, relative to the application of the T.C. for a loan of £1,000 for mains, services and transformers. There was some opposition on account of the high rate of interest on loans taken up now.

Salford.—NEW TURBINE PLANT.—The T.C. has decided, by 28 votes to 9, that the cost of the 5,000-KW. turbo-alternator (£19,225) which is to be purchased, be defrayed out of the depreciation fund.

Scarborough.—PRICE INCREASE.—The Scarborough Electric Supply Co. has decided to increase, after June 30th, the charge for electrical energy for all purposes by 10 per cent.

South Africa.—*The S.A. Railways and Harbours Magazine* gives some particulars of the power station at Luderitzbucht, now being worked by members of the S.A. Engineers Corps, under the control of Lieut. Davies. The plant is mainly for supplying the diamond mines, and consists of seven large gas producers and one small one, with the necessary purifying plant, and the following Körting gas engines:—One of 155 H.P., two each of 600 H.P. (four cylinders), and two each of 1,000 H.P. (four cylinders), in each case coupled to a Siemens-Schuckert alternator. Current is supplied to the mines at 30,000 volts pressure. A large pumping and air-compressing plant is installed, and the coal yards contain about 2½ years' supply of Welsh anthracite for the gas plant.

Stalybridge.—LOAN SANCTION.—The Joint Electricity and Tramways Board has received sanction from the L.G.B. for the borrowing of £4,000 for transformers and mains.

Stirling.—The surplus on the Corporation electric light undertaking for the year was £519. This sum is to be added to the reserve fund.

Stoke-on-Trent.—YEAR'S WORKING.—The accounts of the Potteries electricity undertaking presented last week show that the total revenue was £55,159; the total works expenditure, £32,418; and the gross profit, £22,741; while loan and interest charges accounted for £21,565. The total units sold amounted to 7,432,910. The total expenses amounted to £55,046, compared with £58,723 in the previous year, or a reduction this year of more than £3,600; against the loss of £6,162 in the previous year, there is a profit of £71, which justified the Committee's power supply scheme. Last year 10,500,000 units were generated, an increase of 1,500,000, on a reduction of over 4,000 tons of coal, showing a saving of £2,800. But for the war a profit of £6,000 would have been anticipated.

LOAN SANCTIONS, &C.—The T.C. has made a further advance of 10 per cent., making 20 per cent. increase, in the price of current, owing to the high price of fuel. The Local Government Board has sanctioned loans as follows:—£19,150, excess expenditure to March 31st, 1914; £130, wagon shed at Hanley; £6,266 mains; £3,482, machinery, services, and sub-station equipment. Regarding a further loan for a rotary converter at the Longton sub-works, the L.G.B. intimates that it is in communication with the Treasury. The remainder of the loans asked for, which amount in all to £56,230, has not been sanctioned.

Tunbridge Wells.—YEAR'S WORKING.—The annual report of the electricity department shows a total income of £18,613, an increase of exactly £2,000 during the year. Units sold for private purposes increased by 23 per cent. The capital expended on the undertaking amounts to a little over £100,000, whilst the liability is under £30,000. The gross profit increased from 8·9 to 9·8 per cent, and the net profit increased from £2,165 to £3,167. The total increase in units sold was 208,000.

Wallasey.—PRICE INCREASE.—The T.C. is recommended to increase the charges for current as from the end of September as under:—Lighting, to 4d. per unit, with a reduction to 3½d. on all current consumed over 2 units per quarter per each 8-C.P. lamp wired; free wired installations, 1d. per unit increase; motors, to 2½d. per unit; heating and cooking, to 1½d.

Wrexham.—PROV. ORDER.—The T.C. has informed the R.D.C. that it is intended to apply to the B. of T. for a prov. order extending the area of supply to the Garden Village outside the borough, and suggesting that other places in the rural area should be included. The R.D.C. has decided that the several parishes in the district concerned shall be consulted in the matter.

TRAMWAY and RAILWAY NOTES.

Australia.—The lease of the Melbourne Tramways and Omnibus Co. expires in about a year, and, according to the *Argus*, the Tramway Trust, which was created to act as the executive of the municipalities in their relations with the Tramways Co., has initiated proceedings for the purchase and transfer of the company's holdings. It has ascertained that the company is prepared to treat with it as to terms, and the constituent municipalities are now being asked to approve the proposed step. There appears to be some doubt as to the attitude of the Government in the matter, as it is said that a section of the members would like to see it in control of the tramways.

Birmingham.—The T.C. has applied to the B. of T. for an extension of time to September 2nd, 1918, for the completion of the light railways authorised by the 1912 order, and the Quinton order for 1913.

Blackpool.—FEMALE LABOUR.—Ten women car conductors are now employed on the cars, their wages being the same as those paid to male employés—5¾d. per hour—but the hours worked being fewer.

From May 14th to June 17th the receipts on the cars amounted to £7,805, a decrease of £1,377 on the corresponding period of 1914, and since April 1st the decrease recorded is £3,475.

Bolton.—WAGES INCREASE.—The Tramways Committee has offered to pay its employés an advance of a farthing an hour from the first pay day in October, which the men's society has decided to accept along with the condition that no further application for an increase of wages is to be made until July, next year.

Continental.—SWITZERLAND.—The Swiss Federal Railway authorities have decided on the construction of a large new hydro-electric station at Massaboden, near Brigue, to supply the necessary electrical energy for the propulsion of the trains through the Simplon tunnel. The plant, which will replace the temporary power station at the north end of the tunnel, will be equipped with two turbines working under a head of 141 ft.

Glasgow.—In supplement to the analysis of the report on the year's working of the Corporation tramways, an official report was issued early this week, in which it is pointed out that the amount of line and single track open was over 198 miles. There were in use 857 cars, of which 385 were fitted with vestibules. The passengers carried numbered 336,260,758; the average traffic revenue per car-mile was 10·612d., and per mile of single track operated, £5,404.

Hull.—The Corporation Tramways Committee has decided to employ women as conductors. The Lord Mayor said it was not their intention to employ women if men were available. It was proposed to pay the women conductors 27s. per week, the same as men, and to allow the drivers a war bonus of 2s. a week for lifting the overhead trolley at each terminus.

Ilford.—The Tramways Committee has decided not to take action on the question of considering the advisability of obtaining expert advice to assist the Council in formulating a scheme by which the undertaking can be placed upon a sound commercial basis.

Keighley.—The T.C. has applied to the B. of T. for an extension of time to September 20th, 1916, and to September 20th, 1917, for the completion of works authorised by the Tramway Orders of 1903 and 1909.

London.—L.C.C. ANNUAL ACCOUNTS, &c.—For the year ended March 31st, 1915, the County Council's system extended over 150 street-miles of tramways, 5¾ miles being horse lines; only 146 miles, however, were in operation. The services on the remaining horse tramways have now been suspended pending electrification. The total income for the year amounted to £2,399,847 (including £10,800, horse tramways), and the working expenses to £1,700,571 (including £16,327, horse tramways), leaving a gross surplus of £699,276. Against this has to be set debt and other charges amounting to £732,448, leaving a deficiency to be met out of general reserve fund of £33,172. There will be nothing available for the renewals fund which, on March 31st last, amounted to £402,045, and the general reserve fund, after meeting the deficiency mentioned, amounted to £163,050. The total operating expenses (including £42,209 war service allowances) amounted to 6·89d. per car-mile, as against 6½d. per car-mile in 1913-14. The total receipts in respect of electric traction amounted to 9·77d. per car-mile, as against 9·21d. in 1913-14. The passengers carried totalled 550,497,993 (including 3,244,661, horse tramways), and the car-miles run were 58,706,161 electric, 272,631 horse, a total of 58,978,792. The electric traction receipts for 1913-14 were for 136 track-miles, £2,181,344; and for 1914-15 for 140 track-miles, £2,323,130; the average receipts per mile showing an improvement. The capital debt at March 31st, 1915, amounted to £13,744,806, and the net debt to £9,836,187. Capital expenditure amounting to £1,930,396 had become obsolete, owing to the electrification of the horse tramways, and £966,232 was still to be provided for under this head, as also £5,006 under a similar head for electric traction.

The report draws attention (as usual) to the amount paid in rates on permanent way for the year, £87,827, equal to ½d. in the £; to annual saving to road authorities by the Council maintaining paving along tramway routes, £134,400; cost of street improvements charged to tramways, £673,775. In all it is estimated that local rates are relieved by £298,376 a year. A total of 45,785,729 passengers travelled in workmen's cars (2d. return and 1d. single tickets, average length of route, 5 miles).

The report deals at some length with through running facilities which have been introduced with adjoining tramways and with the London Electric Railway Co. (Highgate—Charing Cross), and concludes by pointing out the improving receipts up to the outbreak of war, the extra cost of coal since the war £15,757, and the cost of war allowances £42,209.

The annual estimates of the Highways Committee for 1915-16 show in respect of the tramways a net deficiency of £91,614.

However, since this result was arrived at, the tramway strike has taken place, which it is considered will result in a net loss of £100,000, and together with other charges it appears that the reserve fund may be exhausted and a further amount be left to be found from other sources.

One can quite appreciate that the Committee views "with concern the probable financial results for the current financial year having regard to the heavy additional charges on the undertaking and loss of traffic revenue owing to the war and the strike." Apparently the only crumb of comfort held out by the Committee is the prospect of reduced debt charges in "a few years' time."

South Africa.—For the half-year ending December 31st, 1914, the Pretoria Corporation tramways showed a net loss of £5,379.

At Germiston a public meeting recently passed a resolution earnestly requesting the Tramways Committee to take steps to minimise the loss on the tramway system.

The Johannesburg municipal tramway system for March made a profit on the month of £2,233.

Stockport.—RESERVE FUND.—The Tramways Committee has decided to invest the reserve funds of the tramway department in the new War Loan.

West Hartlepool.—YEAR'S WORKING.—The result of the working of the Corporation tramways for the year ended March 31st, was a net profit of £3,018, which was placed to the reserve fund, now amounting to £4,614. Compared with the previous year, all the routes showed increased receipts, the total being £4,000 ahead of that of two years ago. The passengers carried numbered 4,261,917, or 8·89 per car-mile, representing 9·77d.; operating expenses were 5·80d., leaving gross profit amounting to 3·97d. per car-mile.

TELEGRAPH and TELEPHONE NOTES.

German Cables.—The severed cable communication between the United States and Germany, *via* the Azores, has not been restored because of the opposition of Great Britain and her allies. The German Government submitted to the United States a proposal to repair and re-open the cable if the consent of the British Government could be obtained. This proposal was communicated through Ambassador James W. Gerard, at Berlin, to Secretary Bryan, under date of February 27th, 1915, but no response was ever made by the British Government. Without the consent of the British Government it would be worse than useless to repair and re-open the cable, for the reason that Great Britain, if opposed to its use during the war, could cut the cable just as easily after its restoration as in the early days of the war.—*T. and T. Age.*

Panama Canal.—In order to avoid confusion in the sending of wireless telegrams, a general order has been issued by the authorities of the Panama Canal, prohibiting the sending of long-distance messages by vessels within the jurisdiction of the canal.—*T. and T. Age.*

Tireless Wireless.—Two years ago a wireless message was sent from a steamer off the coast of Japan to a man in Peking, China. The message went all over China in search of the man, and was finally delivered to him in December, last year, after being 22 months on the way. This is a victory for wireless.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—Aug. 11th. One 1,000-KW. D.C. generator complete, liquid starter, &c., for City Council. See "Official Notices" June 4th.

July 27th. A.C. and D.C. meters and maximum-demand indicators, for the City Council. See "Official Notices" June 25th.

August 11th. Victorian Railway Commissioners, Spencer Street, Melbourne. Twenty miles of vulcanised-rubber electric light wire (Contract No. 28,925). Local representation. Deposit, ½ per cent. of amount of tender.*

ADELAIDE.—August 18th. Magneto and trembling bells, for P.M.G.'s Department. See "Official Notices" to-day.

PERTH.—August 11th. Bolts and nuts, tubular brackets, side brackets for tubular iron poles, &c., Cordeaux and other insulators, copper wire, &c., for the P.M.G.'s Department. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

Barking Town.—July 16th. U.D.C. 1,000-KW. turbo-alternator with condensing plant; cooling tower and pipework; chain-grate stoker, boiler pipe work, &c.; economiser; rotary converter; H.T. switchgear; H.T. main. See "Official Notices" to-day.

Dublin.—July 12th. Corporation. 122,000 carbons. See "Official Notices" to-day.

Edinburgh.—July 12th. Corporation. One 1,000-KW. motor converter and transformer. See "Official Notices" June 25th.

July 14th. Corporation. Electric lighting installation at public wash-house, McLeod Street. Mr. F. A. Newington, Engineer, Dewar Place.

Erith.—July 5th and 19th. U.D.C. One water-tube boiler with superheater, economiser, automatic stoker, steel chimney, induced-draught plant, steam valves, steam pipes, and all auxiliaries. One 2,000-KW. turbo-alternator, with condensing plant, switchgear, and all accessories. See "Official Notices" June 18th.

Kingston-upon-Hull.—July 22nd. Corporation. One 5,000-KW. turbo-alternator with exciter; one condenser outfit complete. See "Official Notices" to-day.

Manchester.—July 9th. Washed and dry coal slack during the year ending June 30th, 1916, for the Electricity Department. Mr. F. E. Hughes, Secretary, Town Hall.

Morecambe.—July 24th. Corporation Electricity Department. 2,000 tons of coal or slack. See "Official Notices" to-day.

Rangoon.—August 11th. Installation of a system of fire-alarms, for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

South Africa.—August 3rd. 200 H.T. links for power station (Contract No. 998), for Johannesburg Municipal Council. Specification, &c., can be seen at the B. of T. Commercial Intelligence Branch in London, and obtained from the Controller of Stores, Municipal Offices, Plein Square, Johannesburg.

Tasmania. — LAUNCESTON. — July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Trowbridge. — July 7th. Public lighting for three years, for the U.D.C. The Surveyor.

Walsall and West Bromwich.—July 5th. Lighting; heating apparatus: drainage and septic tanks, for Unions Joint Committee. See "Official Notices" June 18th.

Warrington.—July 7th. 6,000 tons of slack coal for the electricity works for six months, or, alternatively, 10,000 tons during the 12 months. Specifications (one guinea, returnable) from Mr. F. V. L. Mathias, Electrical and Tramway Engineer.

CLOSED.

Bolton.—The Electricity Committee has accepted the following coal tenders for next year:—

J. Hilton & Sons.—3,000 tons 6-ft. slack.
J. B. Scholes & Sons, Ltd.—5,000 tons rough 4-ft. slack, and 15,000 tons of Ellerbeck rough Arley slack.
Earl of Ellesmere.—2,600 tons of rough dry slack.
John Briggs & Sons.—3,000 tons of best slack.

Brighton.—The B. of G. has accepted the tender of Mr. H. J. Galliers, of Brighton, for electrical fittings, at £64.

Hull.—The Board of Guardians has accepted the tender of Messrs. Clark & Graham for electrical work and supplies during six months.

London.—The Alpha Manufacturing Co. has lately received the following contracts:—

Metropolitan Asylums Board.—Electric heating at head office, and lighting at the Western Hospital Fulham.
The lighting of H.M. Auxiliary Stationery Office, Borough Road.

The following tenders have been received by the London Education Committee for installing electric light in two schools:—

COUNTY SECONDARY SCHOOL, SOUTH HACKNEY.

Alpha Manufacturing Co.	(accepted)	£562
A. Hawkins & Sons		564
G. Weston & Sons, Ltd.		697
Titan Lift Co., Ltd.		746

SEBBON STREET, ISLINGTON.

T. W. Vaughan & Co. (1914), Ltd. ..	(accepted)	£306
A. Hawkins & Sons		383
Alpha Manufacturing Co., Ltd.		391
T. H. Smerdon		418
Albion Electrical Co., Ltd.		420
Titan Lift Co., Ltd.		431
G. Weston & Sons, Ltd.		432
Temple Bros.		445

ST. PANCRAS.—For the supply of coal for 12 months for the electricity generating stations only four tenders were received which included delivery. In regard to the contract of Messrs. Beattie & Co., which expired on June 30th, the Committee had pointed out to the firm that the shortage of supply, which resulted from the diminished output of the collieries and the use of the railways by the Government for military purposes, had had to be made up by the Council at much higher prices than that contracted for. Messrs. Beattie, with a view to meeting the Council, after negotiation with the colliery, have offered that, if their contract is accepted by the Council for the ensuing year, they will make a reduction in respect of the first 1,000 tons of Newdigate beans of 5s. 2d. per ton, and the first 500 tons of Newdigate nuts of 5s. 5d. per ton, the remainder of the quantities to be taken at the prices quoted in their tender.

The Committee recommended that the tender of Messrs. J. H. Beattie & Co. be accepted for coal for the year ending June 30th, 1916, as follows:—

5,100 tons of Haunchwood hard steam coal, at £1 8s. 5d. per ton, for Regent's Park station.
9,600 tons of Newdigate beans, at £1 1s. 11d. per ton.
1,000 tons of ditto, at the reduced rate of 16s. 9d. per ton.
4,800 tons of Newdigate D.S. nuts, at £1 3s. 11d. per ton.
500 tons of ditto, at the reduced rate of 18s. 6d. per ton, for the King's Road station.

Subject to the provision that, should any action of the Government lead to a reduction in prices at the collieries, the present prices shall be correspondingly reduced.

Luton.—The T.C. has been recommended to accept the tender of the British Thomson-Houston Co., Ltd., at £2,250, for two 500-KW. converters; and that of the B.I. & Helsby Cables, Ltd., for 5,600 yards of ·15 sq. in. H.T. cable, at approximately £990 per mile.

Nuneaton.—The T.C. has accepted the following tenders for the electricity works:—

W. Lucy & Co., Ltd.—House-service cut-outs: 10 and 15-ampere sets, 5s. 8d. per set; 50-ampere sets, 9s. per set; street-lighting brackets, 15s. and 16s. 9d. each.
Nuneaton Engineering Co., Ltd.—House-service joint boxes: small, 4s. 6d. each; large, 5s. each.
Mr. W. Jeffcoate.—1,260 tons fine smudge coal, 8s. 4d. per ton delivered.

Oldham.—The Education Committee has accepted the quotation of the Corporation Electricity Committee for carrying out the lighting of Higginshaw Mixed School (approx. cost £200).

Rugby.—The U.D.C. has accepted the tender of the Macintosh Cable Co., Ltd., for cables; and that of the British Thomson-Houston Co., Ltd., for a transformer control panel. The lowest tender for cable was rejected, as it was ascertained that the firm tendering had practically the whole of its share capital held in Germany.

Southampton.—The Electricity Committee has accepted the offer of Messrs. Bradbury, Son & Co. for 3,500 tons of Tamworth coal, at 22s. 10d. per ton; and is to invite alternative tenders for the supply of coal during periods of three, six and twelve months.

Watford. — The U.D.C. has accepted the tender of Messrs. E. Foster & Co. for 2,000 tons of Newdigate peas coal for the electricity works, at £1 1s. per ton, subject to 2d. per ton extra per 2½ per cent. rise in miners' wages during the contract period of 12 months.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Monday, July 5th. At 5 p.m. At Albemarle Street, W. General Meeting.

NOTES.

Engineering Congress at San Francisco.—We have received from the Committee of Management of the International Engineering Congress, to be held in September, a copy of the general programme covering the conventions of the four American Societies of Civil, Mechanical, Mining, and Electrical Engineers. It gives particulars of the excursions, &c., and contains a form for use in informing the Committee of one's plans and requirements in the way of accommodation, &c. Copies of the booklet can be obtained from Mr. W. A. Cattell, secretary, International Engineering Congress, 417, Foxcroft Building, San Francisco, Cal., U.S.A.

Electric Dust Vans: Birmingham.—The electric supply department has ordered two Mossay electric vehicles, which are to be hired to the refuse disposal department, with a view to demonstrating to other users of haulage vehicles their suitability for town work. These two vehicles are to be used in the Harborne district in the collection of house refuse from portable ashbins, the refuse being taken to California tip; they will replace four horses, and a spare horse, drawing four-wheeled wagons. As a preliminary, several tests were carried out with an Edison electric dust-van, and Mr. Jackson, the superintendent of the refuse disposal department, reports that they fully demonstrated that one electric could easily displace two horses, and in Birmingham, where 275 horses are engaged in refuse disposal work, this would reduce by half the clerical work in weighing and inspection of vehicles; it would be more cleanly, and owing to the possibility of using electric light, would reduce accidents, which occur through bad lighting of the present vehicles. A horse and wagon removes three loads a day, stopping at 150 houses, which rules out the petrol vehicle.

Mr. Jackson gives, as a basis of comparative cost, the following figures:—

CAPITAL COST.

Edison. 3-ton.	Mossay. 2½-ton.	Mossay. Revised estimate for 3-ton.	Two horses and wagons. 3-ton.
£1,075	£650	—	£250

Running cost per 135 miles per week.

£11 1s. 1d.	£10 9s. 5d.	£11 2s. 4d.	£10 4s. 0d.

In the estimate 10 per cent. depreciation and interest at 4 per cent. per annum are included; the driver's wages are reckoned at 35s. per week, or 5s. more than for horse drivers, and electricity is reckoned at ½d. per unit, obtained from the destructor plant. Judging from the details mentioned in the report, for which we are indebted to Mr. Jackson, it would appear that the electric vehicle cost is, if anything, overstated, especially if a number of such vehicles are to be employed.

Institution and Lecture Notes.—Tramways and Light Railways Association.—The seventh annual Congress of this Association is to be held at the Institution of Civil Engineers Great George Street, Westminster, S.W., on Friday, July 16th, at 10.30 a.m.

The papers to be read are as follows:—

"Glimpses into the Obvious," a paper on tramway management, by Mr. A. V. Mason, M.I.E.E., general manager and engineer of the South Metropolitan Electric Tramways and Lighting Co.

"Tramways during War Time," by Mr. J. W. Dugdale, general manager, Oldham Corporation Tramways.

"Electric Battery Vehicles as Adjuncts to Tramways," by Mr. W. H. L. Watson.

An informal dinner will be held in the evening at the Trocadero Restaurant.

Society of Engineers (Incorporated). — On June 17th the members of the society and their friends visited the works of the Edison & Swan United Electric Light Co., Ltd., at Ponders End, Middlesex.

Appointments Vacant.—Deputy general manager of electricity supply department (£650), for Municipal Council of Sydney, N.S.W.; chief assistant electrical engineer (£120), and switchboard attendant (30s.), for Leek U.D.C.

Electrical Prosperity Week.—Sectional Committees to supervise the Electrical Prosperity Campaign in every State of the Union have been appointed by the Executive Committee of "Electrical Prosperity Week." Nearly 200 of the leading electrical men of America, representing all the interests of the electrical industry, have been invited to take charge of local campaigns. Pledges have been received at the Executive Offices of the Society from the leading industries in other fields that the electrical industry can be assured of their support. The Society will issue before July 1st a prospectus of the campaign and all proposed plans.

Parliamentary.—The following Acts have received the Royal Assent:—

Ormskirk Gas and Electricity Act.
Bristol Tramways Act.
Metropolitan District Railway Act.
Sheffield Corporation Tramways Act.

Accident.—Albert Craven, of Blackpool, a jointer in the employ of British Insulated and Helsby Cables, Ltd., met with an accident while working in an electric manhole at Blackburn on June 24th. A lighted candle fell on some insulating material lying at the bottom of the manhole, which was instantly filled with flame. Craven was severely burned on the hands, face and neck

Australian Contracts and Arbitration. — With further reference to the subject of municipal contracts and arbitrators in connection therewith, with which we dealt editorially in our issue of May 28th, the *Melbourne Argus* just to hand states that consideration has been given to this question by the Melbourne City Council. The report of the Legislative Committee bearing on the subject has now been adopted in the following terms:—

"In the existing conditions of contracts, which are supervised by the city surveyor or the city architect, it is provided that where disputes or differences arise in connection with the contract, the same shall be referred to and settled by the city surveyor or city architect, as the case may be. The conditions of contract for electric supply works provide that disputes shall be referred to and decided by arbitrators, one to be appointed by each party, and an umpire, to be appointed by the arbitrators. The Committee consider that the principle for settlement of disputes should be uniform in all contracts entered into by the Council, and, after consideration of the principles contained in the conditions of contract of various bodies, they are of opinion that the appointment of one arbitrator, to be agreed upon by the parties, and to be named in the contract, will meet all requirements. They therefore recommend adoption of this principle by the Council, and that the arbitrator shall be a member of the Royal Victorian Institute of Architects, the Victorian Institute of Engineers, or the Electrical Association of Australia, as the case may require."

A fourth alternative in the direction of a representative of the Master Builders' Association was negatived, after discussion, by 14 votes to 7.

Italy's Electrical Trade in 1914.—The following is a summary, from the *Revista Tecnica d'Elettricità*, of the progress of Italian electrical trade in the past year:—Imports of machines weighing above 1 metric ton amounted to 32,000 metric quintals, against 2,000 for 1913, of which the contribution of Germany was 26,500, accounting for the greater part of the increased imports; those of Switzerland showed a slight advance, while the shipments from England and Austria were less than in the previous year. Imports of lighter machines showed a diminution, being 12,500 metric quintals, against 15,000 in 1913. England and Switzerland each made small advances on their previous year's shipments, while those of Germany suffered a decline, the greater portion of which is claimed as evidence of Italy's improved manufacturing powers. On the other hand, imports of transformers markedly advanced, being 24,600 metric quintals, against 13,300 in 1913, Germany supplying about half, and other countries furnishing small increased supplies. Germany's share of the aggregate of Italian electrical imports totalled 48,000 metric quintals, against 34,000 in 1913, the total Italian imports of this group amounting to 73,700 metric quintals. Of electrical apparatus weighing less than a metric quintal, the imports last year were 7,500 metric quintals, against 8,600 in 1913. Imports of arc lamps continued their previously marked decrease, being only 250 metric quintals against 550 in 1913, and 660 in 1912. Incandescent lamps figured for 9,250,000 articles against 9,670,000 in 1913. Imports of electric furnace carbons sprang from 8,000 metric quintals to over 120,000; while carbons for other electric uses receded from 10,000 to 9,900 metric quintals. Bare copper wire (0·5 mm. diameter) rose from 8,700 to 10,000 metric quintals, while covered wire imports fell to 2,100 against 3,600 in 1913; cable imports recorded 6,200 against 8,350 metric quintals in the preceding year—the falling-off in each case being attributed to the increased production of Italian works. As regards Italian exports of electrical wares, diminution is noted in heavy and light machines and in transformers; and insulated copper wire fell from 10,000 to 7,500 metric quintals, but cables rose from 13,000 to over 26,000 metric quintals, the chief client being Argentina, whose higher purchases compensated for losses elsewhere. Electrical apparatus figured for less than 400 metric quintals. Carbons for electric furnace electrodes rose, however, from 400 in 1913 to 2,300 metric quintals, and other carbons from 9 to 200 metric quintals an improvement indicative of future possibilities. Taken altogether, however, the export trade is considered to afford few motives for satisfaction.

Fatalities.—ELSWICK-ON-TYNE.—An inquiry was held on June 23rd, at Newcastle-on-Tyne, as to the deaths of Thomas Leadbitter Harrison, 28, Hobson Colliery, Burnopfield, and Edwin Stanley Bubb, 18, who died as the result of an accident at the Western Power Station of Messrs. Armstrong, Whitworth and Co., Elswick-on-Tyne.

Thomas Nichol, an engine fitter at the works, said some hydraulic and electric pumping plant was being erected at the station, and on June 11th, the day of the accident, witness and others were fixing a pressure pipe to a tank. The work was commenced before the electric light was required. Harrison, Bubb and other men wanted to finish the work, and did not leave at the usual time for supper, but witness went for his. On returning he found that Harrison had been killed. Two men were applying artificial respiration, and three other men had been removed to the infirmary. Examination showed that the insulation of a wire had been damaged and the wire exposed. He concluded that an iron girder had been charged with electricity through the insulation of the wire being damaged and the wire coming into contact with the girder. In answer to a representative of the Home Office, witness said the only place they could put the pole for lifting weights was on the girder. The pole was not in use at the time of the accident. He thought the pole must have rolled on to the wire.

John Thomas Temple, an enginewright, said he had just sat down for supper when he saw Stuart Bubb fall from the tank to the ground. On reaching the top of the tank by a ladder, witness found Stanley Bubb partly immersed in the water, and leaning against the partition of the tank partly unconscious. A man named Havery was in a similar condition. Witness called for assistance, and Harrison went to get hold of Havery, stepping past witness. To support himself Harrison got hold of the girder, and as soon as he did so his legs dropped into the tank. Witness then knew that the girder had become electrified, and he called for the current to be cut off. As soon as this was done Harrison released his hold of the girder and fell into the tank. Artificial respiration was tried for ten minutes, or it might have been longer.

The Home Office representative commented on the time stated by witness that artificial respiration had been applied. He pointed out that it should not be given up under two hours. There was a case on record where a man was brought round at the end of that time, and after life had been pronounced extinct by a doctor. The fact was not generally known amongst medical men. He thought it would be well if instructions were issued to ambulance men on that point.

A verdict was returned to the effect that Harrison and Bubb died from electric shock received through taking hold of a steel girder, which had been electrified through an electric cable becoming damaged.

GATESHEAD-ON-TYNE.—An inquiry into the death of Thomas Lewis, a youth employed at the Redheugh Steel and Iron Co.'s works, was held on June 24th. Archibald Allen, aged 16, said that on June 18th they went to work, and at 11.40 p.m., during a rest interval, witness and Lewis strolled through the works and Lewis went towards a pole where an electric lamp was hanging. Lewis put his hand out as though to touch the wire, and lifted his foot to get on to a sleeper. The lad then fell back, and when witness touched him he received an electric shock. Efforts were made to get him off the wire which he was holding, but these failed, and witness went for assistance. When he got back Lewis was on the ground apparently dead. Richard Stamp, a furnaceman, said he saw Lewis holding the lamp wire with both hands. Witness made several attempts to free Lewis, and received a severe shock, but eventually got him off. Thomas R. Parry, Dunston, electrical engineer, said there was evidently a fault in the insulation of the lamp which caused the casing to be alive. He suggested that the suspension wire became alive through coming into contact with the shade of the lamp, and that could only have occurred by pulling the lamp up by the suspension wire. The jury found that the boy had been accidentally killed by improperly taking hold of a lamp suspension wire which had by some unaccountable means become charged with electricity.

BURY.—On Monday, a verdict of "Accidental death" was returned in the case of Alfred Nicholson (27), electrician, of Manchester, who, while working on a ladder at the Radcliffe Paper Mill, fell to the ground and fractured his skull.

Ediswan v. Siemens Rifles.—A friendly shoot between the "Ediswan" Rifle Club and a team from Siemens Rifle Club was decided on the "Ediswan" range last Saturday. There was a very good muster. Siemens put 17 men in the field, including Mr. Holmes (sales manager), Mr. Hicks (assistant sales manager) and Mr. Pryor (hon. sec. to the club). The "Ediswan" team were equal in number, and included Messrs. Child and Elliott (joint sales managers), and Mr. Corbett (hon. sec.). The shoot resulted in a win for the home team by 1,284 to 973. Spoons were given for the highest score on each side, also wooden spoons for the lowest scores, and a mystery prize completed the trophies.

The prizes in the team match were awarded as follows:—

Highest score, "Siemens," Mr. Fowler, 97.
"Ediswan," Mr. Black, 91.
Lowest score "Siemens," Mr. A. N. Other, 2.
(Booby spoon) "Ediswan," Mr. Elliott, 48.
Mystery, "Ediswan," Mr. Swallow, 87.

After the "shoot" the party, of nearly 50, adjourned to the staff café for tea, and a vote of thanks to the hosts was proposed by Mr. Holmes, and responded to by Mr. Elliott, after which the latter presented the prizes. Having taken tea, another match of six a side was decided in favour of the "Ediswan" men, by 518 to 492.

Diesel Engine Users' Association.—At the June meeting of the Association, the question of a suitable allowance for depreciation of Diesel engine plant in connection with income-tax assessment was considered. It was generally felt that the present practice of allowing only 5 per cent. for depreciation, and that only on the diminishing capital value, was quite insufficient for the purpose. Mr. Arthur D. Bird, of Messrs. Humphreys-Davies & Co., who had been invited to attend the discussion, referred to Sec. 12 of the Customs and Inland Revenue Act, 1878, which enacts that a "just and reasonable allowance should be granted as representing the diminished value by reason of wear and tear during the year, of any machinery or plant used for the purpose of the concern." The two principal questions, therefore, for consideration were:—(1) What was wear and tear?, and (2) What constituted a just and reasonable allowance? With regard to the first question, the legal allowance was limited to the physical deterioration of machinery and plant in use, and no deduction for any loss arising from obsolescence was legally claimable. For this reason, among others, it was important that the annual allowance for depreciation should be fair and ample, and that reliance should not be placed on a claim for the difference between scrap value and the original value at the end of the life of the plant. In support of this point, he mentioned the decision in the appeal of the London County Council Trams *v.* Edwards, in which it was held that the unexhausted value of the London County Council trams, track, &c., which had been replaced by electric traction, was not an admissible deduction in arriving at the taxable profits. Mr. Bird referred to the case of a company generating current, subsequently ceasing to do so and purchasing its supply elsewhere; also to the case of new plant being installed upon a larger site. In these cases the losses arose from causes other than of obsolescence of plant; in the first case there was a change of business, and in the second case the plant had become useless, due to the original site having become too small. It was also pointed out that any allowance other than an annual deduction for wear and tear was a concession by the Board of Inland Revenue and had no statutory force; further, that it was conditional upon the replacement of the obsolete plant. Mr. Bird also referred to the method adopted by the Inland Revenue Authorities in granting allowances for wear and tear, viz., upon the reducing balances of value, and he pointed out that where an allowance was limited to 5 per cent. per annum on the diminishing value, a residual or scrap value of 4 per cent. was only reached after about 60 years. An allowance at the rate of 10 per cent. per annum reduced the capital figure to about 4 per cent. after 30 years. At the time the arrangement was come to for granting allowances for depreciation in respect of machinery and plant at electricity generating stations, the Diesel engine was practically unknown for central station work, and it could, therefore, not be urged that such an arranged allowance covered depreciation of that particular class of plant; further, any such arrangement could not be considered to be binding for all time. As a matter of law, the Commissioners of Taxes were the tribunal who determined the allowances to be made, and they were empowered to vary them annually if the circumstances warranted it. Mr. Bird also made a comparison between the allowances granted to gas companies under the scheme entered into with the Inland Revenue Authorities, from which it appeared that they had obtained various concessions which were not accorded to electricity generating undertakings. After some discussion the question was adjourned for further consideration.

The next meeting of the Association is to be held on July 21st, when the questions of lubrication and of cracked pistons are to be further discussed. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, 19, Cadogan Gardens, London, S.W.

Russian Copper Production.—The increasing production of copper in Russia in 1910, 1911 and 1912 rendered it probable, according to the report of the Russian Copper Syndicate Medj in 1912, that the country would become entirely independent of any external supplies in the course of the year 1915. This assumption was apparently based upon the fact that the output had reached, at 33,100 tons in 1912, the highest level ever attained, and that it would continue to expand. In 1913, however, the outturn declined to 32,800 tons, and the returns for 1914 indicate a further reduction to 31,900 tons. It appears that since October operations at one works of the Caucasian Copper Industry Co. have been at a standstill, the resumption of work at one factory of the Siemens (Successors) Co. has been prevented, and a restriction in the number of workmen at all the other works has prevailed. As, however, the production in the first half of 1914 receded by 640 tons as compared with a total fall of 900 tons for the whole of the year, it does not seem as if the war has exercised a very determined influence on the copper industry taken as a whole. The syndicate controlled 91·8 per cent. of the total output in 1914 as compared with 95·7 per cent. in the previous year. The total consumption of copper in Russia last year is recorded at 33,300 tons as compared with 32,900 tons in 1913, so that the imports must have amounted to 1,400 tons, of which 425 tons were purchased in the United States. It is estimated by the syndicate that the production will reach 34,800 tons in the present year.

Educational.—Two Heating Studentships, tenable in the Faculty of Engineering of University College, London, each of the value of £50 a year, together with College fees, may be awarded in July by the Institution of Heating and Ventilating Engineering. Particulars can be obtained from the Secretary of University College, London, to whom applications must be made not later than Wednesday, July 7th, 1915.

Electrical Standardisation in China.—The Engineering Society of China recently held its annual meeting at Shanghai. The chief item in the report dealt with the Electricity Standardisation Committee, which has temporarily suspended its labours owing to the war. The chairman, Mr. A. C. Clear, read the report of the Committee, which stated that the various societies of the world had been approached, and all had expressed their appreciation and approval of the scheme. As soon as the decision of the British Committee is obtained, the report continues, the Chinese authorities might be approached and every effort made to push the matter through.—*Eastern Engineering.*

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Company orders, by Lieut.-Col. C. B. Clay, V.D., Commandant, for week ending July 10th, 1915:—

On Mondays, Wednesdays and Fridays, drills at 6.30 and 7.30 p.m. Technical instruction will be given by Instructors of the London Electrical Engineers for one hour, and squad and platoon instruction for one hour on Monday and Wednesday.

On Friday, Company and squad drill.

Orderly Sergeant, N. H. Fullarton; Recruit Orderlies (Squad 3), C. F. McInnes; (Squad 4), W. H. G. Saunt.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD. BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding). Thursday, July 1st, 1915:—

WEEK-END PARADES.—Saturday.—The Battalion will parade outside Baker Street Station at 2.30 p.m., and proceed by train to Wembley Park. "A" Company, under the command of Mr. F. H. Stevens, will take up a defensive position between the Brent Reservoir and the Metropolitan Railway line. "B." "C" and "D" Companies, under the command of Mr. H. O. King, will detrain at Kilburn Station and endeavour to effect an entrance into Wembley Camp All roads north of the Brent Reservoir and south of the Metropolitan Railway line will be out of bounds. Grounds under standing crops are out of bounds. Mr. W. Ridd will be umpire.

Sunday.—As last week.

A. G. JOINER, *Captain and Adjutant.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Walsall T.C. has increased the salary of MR. A. PRENTICE, station superintendent at the electricity works, from £225 to £250 per annum.

The Nuneaton T.C. has granted the electrical engineer leave of absence, he having accepted a position as lieut.-commander in the Royal Naval Volunteer Reserve, and has voted him an allowance of £200 per annum during his temporary absence, this to be modified in the event of his promotion to higher rank.

Having regard to the fact that it would be advisable to have a recognised deputy electrical engineer in control of the St. Pancras electricity works in the absence of the chief electrical engineer, it is proposed to alter the title of MR. J. T. BARON, resident and supervising engineer, to that of deputy electrical engineer (resident), such alteration to be made without any increase of salary.

MR. W. H. ELLIS, assistant mains superintendent, Chester Corporation electricity department, and lecturer in Electrical Engineering at the Chester Technical Schools, was married to Miss L. M. Laird, of Chester, on Wednesday, June 23rd. The bride was given away by her father, Mr. W. D. Laird, Wh. Sc.

MR. THOMAS H. CLEMENTSON, assistant superintendent of the Clyde Valley Electrical Power Co.'s station at Motherwell, was recently presented by the staff with a marble clock on the occasion of his marriage. Mr. Howie, the works chemist, made the presentation.

Tramway Officials.—MR. J. C. WHITELEY, who has been appointed engineer and manager of the South Shields Corporation Tramways, was, on Saturday last, the recipient of a fumed oak rolled top desk, subscribed for by the staff and employés of the Chatham and District Light Railways Co. Mr. W. Jensen, the general manager, in making the presentation, referred to the valuable assistance he had received from Mr. Whiteley during the past eight years. Mr. Bexley, cashier, seconded Mr. Jensen's remarks, and Mr. Taylor, carpenter, spoke on behalf of the workmen.

MR. F. JEFFERY, inspector on the Bournemouth Corporation Tramways since their construction 13 years ago, has resigned chiefly from health reasons, and the staff have presented him with a silver watch and an illuminated address.

The Ilford U.D.C. has granted the tramways manager, MR. L. HARVEY, permission to join the Volunteer Munitions Brigade.

General.—MR. E. R. PEACOCK, who served on the committee representing the holders of the 5 per cent. first mortgage bonds of the Barcelona Traction, Light and Power Co., has been appointed president in place of the late Dr. Pearson.

MR. H. E. APPS, an electrical engineer in the employ of Messrs. Sandycroft, Ltd., Sandycroft, has received a commission, and is being drafted to the South Wales Borderers.

MR. E. J. NALLY, general manager of the Marconi Wireless Telegraph Co., of America, has gone to the Pacific Coast and Hawaii, in connection with wireless service soon to be extended to Japan, for which preliminary tests are now in progress with the Japanese Governmental stations, now approaching completion.—*T. and T. Age.*

Roll of Honour.—MR. A. P. FEATHERSTONHAUGH, who had been 14½ years on the staff of the County of London Electric Supply Co., Ltd., has been killed in action. Mr. Featherstonhaugh had served in the London Rifle Brigade since November, 1908, and held the rank of Sergeant. MR. G. BOAST, also in the service of the County of London Co., was killed in action while serving with the 23rd County of London Regiment; and MR. P. G. M. BROWN, another employé of the County Co. was killed in action while serving with the London Rifle Brigade.

Private ARTHUR SYKES, of Blackpool, who was killed in action during the charge of the 8th Liverpool Irish, on June 16th, was employed by Mr. Kay, electrician, of Blackpool.

Private GEORGE ROBINSON, of the Liverpool Scottish, was killed in action on June 16th. His officer stated in a letter to his widow that he fell in a charge which would stand for ever as a glorious achievement in the history of the battalion. Private Robinson, who was 30 years of age, was an electrical engineer with Messrs. Dick, Kerr & Co., Preston.

Private ROBERT JOHN MARSH, 15th Battalion of the 48th Highlanders, Canadian Regiment, who has died of wounds received in action in Flanders, was an electrical engineer of Toronto. He was a native of Blackburn.

Private JOHN A. HENDERSON, 6th Manchester Regiment (Territorial Force), who was apprenticed with the British Westinghouse Co., Ltd., has been wounded in the left thigh in action in the Dardanelles, and is in hospital at Malta.

Sergeant JAS. GORDON, 5th South Lancs. Regiment, on the staff of the B.I. and Helsby Cables, Ltd., of Prescot, has been killed in action. He was 22 years of age.

Private R. J. THOMAS, 1st Dorset Regiment, who was on the clerical staff of the British Westinghouse Electric and Manufacturing Co., Ltd., has died in Flanders from gas poisoning. He was 31 years of age.

Private TOM HEALEY, till recently employed by Mr. W. Caton, electrical engineer, Oldham, has been killed in action in the fighting in the Dardanelles. He was 19 years of age, and was serving in the 10th Manchester Regiment.

Private W. BRAMWELL, of the Royal Scots Fusiliers, a reservist who upon the outbreak of war was called up from his employment at the United Electric Car Co.'s works, Preston, has been killed at the Front.

Private NORMAN LLOYD, of Higher Broughton, has been killed in action. He was an engineer employed at the British Westinghouse Works at Trafford Park, and was 28 years of age.

Private PETER O'HARE, 2nd York and Lancaster Regiment, formerly employed at the British Westinghouse Works, has been killed in action.

Private GEORGE WOOD, in the employ of the St. Helens Cable Co., of Warrington, has been wounded in the chin.

Private JOSEPH BOND, of Warrington, originally reported killed in action, is now stated to be in a hospital in France suffering from wounds. He is 25 years of age, and an employé of the St. Helens Cable Co., Ltd.

Captain A. B. LAYTON, of Stockton Heath, near Warrington, electrical engineer and departmental manager at the soap works of Messrs. J. Crosfield & Sons, has been slightly wounded.

Sergeant SAM MARSH, who was for nine years engaged as a fitter at the Middleton Electric Traction Co.'s shed, has been awarded the D.C.M.

Corporal FREDERICK JAMES BLEWDEN, 1st Battalion Canadians, was killed in action in France on the night of June 15th. He was a son of Mr. J. Blewden, car-shed and workshop superintendent, Portsmouth Corporation Tramways, and was connected with tramway work practically the whole of his life, dating back to the horse-car days in Liverpool. He went to Portsmouth in 1901, when his father was appointed car-shed and workshop superintendent of the Corporation tramways there. In April, 1912, he emigrated to Canada, and from that time until the outbreak of war was employed as an electrical fitter by the Ottawa Tramway Co.

Amongst members of the 4th Battalion South Lancs. Regiment (Warrington), who have fallen in action, are Private CHAS. KNOWLES and Private ARTHUR EARLEY, who were on the staff of the St. Helens Cable Co., Ltd.

We read in the *Times* that Second Lieutenant LAURENCE TURNBULL, 3rd, attached 2nd, Bedfordshire Regiment, who was killed in France on June 16th, was educated at Stephens' Institute of Technology, New Jersey, U.S.A., and on the completion of his college career he obtained an appointment with the Westinghouse Electric and Manufacturing Co., in New York. He returned to England in October last. He had only been at the Front three weeks.

Major J. F. S. LLOYD, of the 6th North Staffs. Regiment of the Territorials, who was killed while with the Forces abroad, was a director of the Weldless Steel Tube Co., of Birmingham. He was 34 years of age.

Second Lieutenant NORMAN C. LOWSON, Special Reserve, Royal Engineers, Glasgow Territorials, son of Mr. James Lowson (senior partner in Messrs. W. C. Martin & Co., electrical engineers, Glasgow), has been mentioned in Sir John French's latest dispatch for gallant and distinguished conduct in the field. He is a B.Sc. in engineering of Glasgow University. His father, Major James Lowson (ret.), who is chairman of the Scottish Local Section of the I.E.E., served 25 years with the old 1st Lanark Rifles.

Corporal A. EVANS, of the 20th Hussars, who was engaged at the works of the Rees Roturbo Manufacturing Co., Ltd., of Wolverhampton, has been killed accidentally by a bomb in France.

Three members of the staff of Siemens Dynamo Works Co., of Stafford, have been mentioned in dispatches, viz., Sergeant G. JACKSON, who is recommended for the Distinguished Conduct Medal, Lance-Sergeant WOLLACOTT, and Corporal ROBINSON. All belong to the Coldstream Guards. Private W. TOMLINSON, of the same regiment, who was with the same firm, has been wounded in action by shrapnel.

Obituary.—MR. C. E. SPAGNOLETTI.—We deeply regret to learn that Mr. Charles Ernest Spagnoletti, M.Inst.C.E., Hon. Member and Past-President of the Institution of Electrical Engineers, passed away on June 28th, at his residence at Hampstead, at the advanced age of 83 years. He had been ill for a week with pneumonia. Mr. Spagnoletti, who was of Italian noble descent, was born in London, and as a lad was in the employ of the Electric Telegraph Co. As a young man he became chief of the G.W. Railway telegraph department, and during his connection with that and other railway companies (the Metropolitan and District systems) he invented and developed many signalling devices and apparatus and other electrical inventions for use in the operation of railways. When the City and South London tube railway was constructed, about 1890, the deceased gentleman was its consulting electrical engineer, and at different times since then he has acted in a similar capacity for other undertakings—the phonopore and the electrical omnibus coming in for a share of his attention. It is 30 years ago this year since he filled the office of president of the I.E.E. when it was known as the Society of Telegraph Engineers and Electricians. Mr. Spagnoletti was one of the original members of the Institution, his membership dating from the year 1872. He has been actively interested in many other societies, and in years gone by played a prominent part as a juror and in other capacities in connection with important home and international exhibitions. Of late, owing to advancing years, he has been less closely identified with the public side of electrical affairs, but by many of the old guard he is intimately remembered, and news of his loss will be learned by them with much regret. Members of the Electro-Harmonic Society will be interested to know that Mr. Spagnoletti was one of the first to approve of the objects of that Society; indeed it may be said that he was the first private individual to be approached by those who had the initiation of the Society in hand, and he gave the proposition then put forward by Mr. H. Alabaster his whole-hearted support. The funeral takes place this afternoon (Friday), at four o'clock, at West Hampstead Cemetery.

MR. A. C. HURTZIG.—We deeply regret to record the death of Mr. Arthur Cameron Hurtzig, M.Inst.C.E., which occurred at his residence at Dulwich on June 26th, at the age of 62 years. Mr. Hurtzig's name will be familiar to our readers by reason of his connection with the Chester Corporation hydro-electric scheme. Mr. Britton's scheme was finally submitted to and approved by him. One of us has had the pleasure of serving on several Committees with the deceased gentleman, and no one could wish to have a more genial and kindly colleague.

The death occurred suddenly on June 19th of MR. ALBERT SHILLITO, of Chelmsford, who was formerly electrical engineer at Eton College. He was 52 years of age.

NEW COMPANIES REGISTERED.

Lowa Engineering Co., Ltd. (140,720).—This company was registered on June 19th, with a capital of £1,500 in 1,000 participating preference shares of £1 each and 10,000 ordinary shares of 1s. each, to carry on the business of electrical, mechanical, sanitary, gas, hydraulic and general engineers and contractors, steel converters, tinsmiths, coppersmiths, metal workers, builders, fitters, wire dealers, galvanisers, japanners, enamellers, electro-platers, manufacturers of theatrical and general stage effects and scenery, fans, lamps, engines, rheostats and electrical apparatus, etc. The subscribers (with one participating preference share each) are: W. Adams, 74, Vauxhall Bridge Road, S.W., engineer; R. F. Hutchinson, 74, Vauxhall Bridge Road, S.W., engineer. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Qualification, £50. Registered office: 74, Vauxhall Bridge Road, S.W.

Electric Lamp Repairs Co., Ltd. (140,740).—This company was registered on June 22nd, with a capital of £5,000 in £1 shares, to carry on the business of collectors and repairers of electric lamps with broken filaments or blackened bulbs, manufacturers of and dealers in electric fittings and globes, etc., and to adopt an agreement with Refilmers, Ltd. The subscribers (with one share each) are: G. O. Barras, 2, Edridge Road, Croydon, engineer; E. G. K. Calder, Rosslyn, The Chase, Coulsdon, Surrey, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are H. Lintott (chairman), G. O. Barras, and E. G. K. Calder. The two last named are joint managing directors with £400 each per annum (free of income tax) as remuneration. Remuneration of H. Lintott £250 per annum (free of income tax). Qualification, 100 shares. Solicitors: Lord & Gunn, 4, Dove Court, Old Jewry, E.C.

Watson & Sons (Electro-Medical), Ltd. (140,765).—This company was registered on June 23rd, with a capital of £25,000 in £1 shares (7,000 preferred), to take over the electro-medical businesses (1) carried on by W. Watson & Sons, Ltd., at 196, Great Portland Street, W., and (2) carried on by L. B. Miller at 66, Hatton Garden, E.C. The subscribers (with one share each) are: C. H. Watson, 313, High Holborn, W.C., manufacturing optician; G. Pearce, 196, Great Portland Street, W., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are C. H. Watson and F. W. W. Baker (both permanent). Remuneration, £50 per annum, divisible. Registered office: 196, Great Portland Street, W.

Peerless Seamless Rubber Co., Ltd. (140,731).—This company was registered on June 21st, with a capital of £2,000 in £1 shares, to carry on at Richmond and elsewhere the business of manufacturers of and dealers in india-rubber goods, raw and waste rubber and rubber substitutes, reclaimed rubber, gutta-percha in raw and manufactured states, fibre and other compounds, celluloid and asbestos goods, packing materials, bottle stoppers, corks, bottles and machinery for bottles, electric cables, wires, fittings and machinery, leather cloth, waterproof and fireproof materials, moulds and machinery for rubber goods, motor tires and accessories, manufacturers of and dealers in motor cars, cycles and boats and accessories, etc., and to adopt an agreement with J. Briere and R. Dequin. The subscribers (with one share each) are: J. Briere, 203, Richmond Road, East Twickenham, motor engineer; R. Dequin, 3, Chudleigh Villas, Whitton Road, Twickenham, manufacturers' agent. Private company. The number of directors is not to be less than two or more than three; the first are J. Briere and R. Dequin. Qualification, £100. Registered office: Station Yard, Richmond.

London Glass Works, Ltd. (140,783).—This company was rgegistered on June 25th, with a capital of £30,000 in £1 shares (29,000 pref.), to carry on the business of glass manufacturers, manufacturers of and dealers in table and household glassware, bottles, jars, lamp and electric light globes and bulbs, and all kinds of glassware for lighting and heating purposes, etc. The subscribers (with one share each) are: C. Brooks, 70 and 71, Chiswell Street, E.C., merchant; H. W. Hill, 80, Finsbury Pavement, E.C., clerk. Private company. C. Brooks is permanent governing director, with power to appoint other directors. Registered office: 70 and 71, Chiswell Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brilliant Arc Lamp & Engineering Co., Ltd.—Particulars of £3,000 debentures, created June 18th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: the company's undertaking and property, present and future, including uncalled capital. No trustees. A memorandum of satisfaction in full on June 18th, 1915, of debentures dated December 11th, 1914, and November 17th, 1913, securing £100 and £300 respectively, has also been notified.

Defries & Goldman, Ltd.—Particulars of £200 debentures, created June 10th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Oriental Telephone & Electric Co., Ltd.—A memorandum of satisfaction to the extent of £900 on June 9th, 1915, of debenture stock covered by trust deed dated June 28th, 1905, and a deed of acknowledgment dated June 12th, 1907, securing £200,000, has been filed.

Telephone Co. of Egypt, Ltd.—A memorandum of satisfaction to the extent of £850, on June 9th, 1915, of debenture stock, covered by trust deed dated July 27th,1904, and three supplemental deeds of acknowledgment dated February 21st, 1906, March 4th, 1908, and October 27th, 1909, securing £200,000, has been filed.

North-Eastern Electric Smelting Co., Ltd.—A memorandum of satisfaction in full on April 20th, 1915, of debentures dated November 13th, 1914, securing £4,500, has been filed.

Carleon Electrical Co., Ltd.—Mortgage, dated June 8th, 1915, to secure £1,500, charged on leasehold premises, formerly part of Lonesome Farm, Norbury, comprising factory and workshops. Holders: Bonecourt Surface Construction, Ltd., Parliament Mansions, Victoria Street, S.W.

South London Electric Supply Corporation, Ltd. (50,392).—Capital, £310,000 in 10,000 preferred shares of £5 each and 65,000 ordinary shares of £4 each. Return dated April 6th, 1915. 6,000 preferred and 65,000 ordinary shares taken up; £4 per share called up on the ordinary and £5 per share on the preferred. Return states £310,000 paid; but last balance sheet says £260,000 on ordinary and £30,000 on preferred, which appears to be correct. Mortgages and charges: £130,000.

Bath, Electric Tramways, Ltd. (74,278).—Capital, £230,000 in £1 shares (75,000 preferred, 125,000 preferred ordinary, and 30,000 deferred ordinary). Return dated April 1st, 1915. 75,000 preferred, 75,606 preferred ordinary, and 30,000 deferred ordinary shares taken up; £1 per share called up on 75,000 preferred and 75,606 preferred ordinary shares; £150,606 paid; £30,000 considered as paid on 30,000 deferred ordinary shares. Mortgages and charges: £155,739.

Simplex Conduits, Ltd. (88,290).—Capital, £100,000 in 10,000 preferred of £5 each and 50,000 ordinary shares of £1 each. Return dated March 23rd, 1915. 10,000 preferred and 40,000 ordinary shares taken up; £5 per share called up on the preferred; £50,000 paid; £40,000 considered as paid on the ordinary. Mortgages and charges: Nil.

Urban Electric Supply Co., Ltd. (57,986).—Capital, £640,000 in 80,000 ordinary shares of £3 each, 50,000 preferred shares of £5 each, and 150,000 unclassified shares of £1 each. Return dated April 14th, 1915. 80,000 ordinary and 50,000 preferred shares taken up; £3 per share called up on the ordinary and £5 per share on the preferred; £490,000 paid. Mortgages and charges: £408,201.

CITY NOTES.

Rangoon Electric Tramway and Supply Co., Ltd.

THE annual meeting was held on June 23rd at 3, Great Winchester Street, E.C. Sir F. W. R. FRYER, K.C.S.I., who presided, said that after providing for all charges, including depreciation and reserve, there remained £8,076 for distribution among the ordinary shareholders, as against £11,674 in the previous year. The directors recommended the payment of a dividend at the rate of 3 per cent., carrying forward £2,765 to the next account. Up to July 31st of last year the receipts showed a considerable increase over the corresponding months of the previous year, the increase to July 31st being approximately Rs. 20,000 and, had conditions remained normal, there would have been every reason to anticipate a record year. As it was, they ended up with a decrease on the tramway receipts as compared with last year of Rs. 49,000. Since the end of March last, however, traffic had shown a tendency to improve, and it was believed that confidence was being gradually regained and that traffic would again come up to reasonable expectations. During the year the experimental motor omnibus service had been maintained with the results shown in the report. In the private lighting and power department there had been an increase in receipts of 11¼ per cent. The working expenses showed a small *pro rata* increase, which was, unfortunately, likely to advance considerably in the future owing to the increased cost of coal and other stores. Negotiations had been proceeding for some time between the municipality and the company for an increased amount of lighting and a revision of the existing arrangements; the directors, fully recognising the public nature of the company's operations, were desirous of meeting the demands of the authorities as far as they could be met with due regard to the interests of the shareholders. With the increased number of installations, the house wiring and supply department had increased its gross receipts, and the profit had also shown a satisfactory increase. A provident fund for the benefit of the staff was started on July 1st, 1914, and all the members under agreement had joined it. The staff had agreed to become subscribers to the fund, and the company's contribution increased the savings by nearly 100 per cent., and so added considerably to the advantage of the service. Owing to the high cost of coal and materials, the board felt that the advantages which they were giving both from the tramways and from the public and private lighting could no longer be continued at the present low rates; but it was only fair to the shareholders that some slight addition to the existing charges be made in order to meet the present high costs. The board had this very important question under their consideration at present. To meet the increased demand for public and private lighting, considerable capital expenditure had already been, and must in the immediate future be, further incurred. That had only been deferred owing to the stringent financial conditions prevailing since last August. In connection with the directorate Mr. Frank Tobin and Mr. James Taylor had resigned their seats on the board, purely for personal reasons. To fill the vacancies the board recommended the appointment of Col. A. C. de Joly de Lotbiniere, C.S.I., C.I.E., R.E., and Mr. H. D. Dickie. For some time past it had been felt that the directorate would be strengthened by the addition of a gentleman having expert knowledge, and in Col. de Joly de Lotbiniere they had a man who had filled the important position of electrical adviser to the Indian Government, during which time he carried through the Mysore and Kashmir schemes.

Mr. JAMES HALLIDAY seconded the motion, and the report was adopted.

Replying to a vote of thanks for presiding, the CHAIRMAN said there was every prospect that they would see a great expansion in the electric supply department of the company in the near future. Many projects were before the board at the present time to that end, but it was difficult to go forward with them while the war lasted. He trusted also that they would see the tramway traffic improve; in fact, it already showed a tendency to do so.

North Melbourne Electric Tramways and Lighting Co., Ltd.

THE results for the year ended September 30th, 1914, show an increase in earnings due to the development of the district served by the company, which benefited both tramway and lighting departments; the extension of the lines over Flemington Bridge also contributed towards the tramway earnings. Revenue per c.m., 10.97d.; car miles run, 463,293; total passengers, 2,874,021; as compared with 10.35d. per c.m., 443,817 car miles, and 2,590,690 passengers in the previous year. Three hundred and ninety-nine lighting consumers have been connected, making the total connections 1,489. Revenue increased by 15 per cent., expenses by 6 per cent., and net revenue by 38 per cent. Capital expenditure during the year amounted to £5,398. The directors record their appreciation of the excellent services rendered by the manager, Mr. Murdoch, and the staff.

Annual meeting: To-day.

Official Notices re Companies.—The following companies will be struck off the register at the expiration of three months, unless cause is shown to the contrary:—

British Automatic Telephone Syndicate.
British Magneto Co.
Consolidated Electric Works and Appliances.
Eclipse Boiler Furnace (London and South).
Gamble's Patent Telephone Recorder Co. (Continental).
Haywards Heath Electric Supply Co.
Magnetic Separator.
Pacific Radiotelegraph Co.
Premier Electric Control.
Radio and Electric Power Co.
Rail and Road Traction.
Silent Day Engine Syndicate.
Spiral Turbine Syndicate.
Sunturbo Engineering Co.
Tramway Construction Syndicate.
Tungsten Metal Co.
United Electrical Construction Syndicate.

Sheerness and District Electric Power and Traction Co., Ltd.

THE total revenue during 1914 was £13,350, and the working expenses £11,489, leaving £1,861. Interest on loan required £543, and debenture interest £1,368, leaving a surplus of £149, which reduces the balance at the debit of revenue account to £1,326. The revenue of the electricity department was £8,842, and the expenses £8,912, representing a decrease in revenue of £625 and in working expenses of £3,151. The units sold were 1,368,885, a decrease of 102,355 due to the outbreak of war and the shortage of labour. The consumers number 270, as compared with 259 in 1913. The traction undertaking (light railways and omnibuses) produced in gross receipts £4,456, and the working expenses were £4,396, resulting in a surplus of £59, as compared with £105 in 1913. The passengers carried increased from 639,000 to 976,440, with the same mileage open and the same number of cars and omnibuses.

British Electric Traction Co., Ltd.

THE annual meeting was held on Friday last at the Holborn Restaurant.

Mr. E. GARCKE, who presided, said that the simplest way of describing the results of the year's operations was to say that they were as in 1913, only better. They were proposing to pay the same dividend on the preference stocks, viz., £52,467, and they placed to reserves and carry forward £82,589 in all, compared with £73,615 in the preceding year. Last year they placed £50,000 to reserve against investments. This year they carried it forward because they did not wish to disturb the estimate of the dividends upon which the scheme of rearrangement was based. The first half of last year gave promise that the results of the whole year would be much better than the figures now produced, but the outbreak of the war altered that as it had altered everything. It was not easy to describe in a few words what had been the effect of the war upon their business as a whole, for the various departments had been differently affected. The tramways and light railways serving holiday centres had suffered serious loss of traffic. On the other hand, the tramways in manufacturing districts, especially those where materials of war were produced as at Barrow, on the Clyde, and at Tyneside, showed large increases of traffic, and some of the smaller towns where troops had been stationed also showed an expansion of business, but the money receipts had not increased in direct proportion to the number of passengers carried, because soldiers in uniform had been allowed to travel at reduced rates and various other concessions and expenses due to the war had had the result that the average fare per passenger showed a slight diminution, and the net profits had in some cases been reduced. The war had hit the motor omnibus part of the business very badly. They were in course of building up a large, and they hoped, profitable business with motor omnibus services in connection with their tramways and light railways, and to some extent in other districts, but on the outbreak of war all their best vehicles were impressed by the Government, and it had been found impossible to obtain replacements because the War Department had also impressed the entire output of the leading motor omnibus factories. Of course they had been paid the fair value of the vehicles, but they had not obtained any compensation for the loss of business. The electrical supply side of the business had, on the whole, been well maintained. In some respects the sale of electricity had been reduced owing to less light being used; on the other hand, the demand for electric power had increased. The Brush Company had been very busy, partly because the new turbine which the company was manufacturing proved a big success. Considering all things, the business results of their operations during the year, might be regarded as satisfactory, and they also showed the advantages of a large combination of varied elements, for while some of their departments had suffered, others had prospered, and on balance they showed some advance. Questions affecting both capital and labour had been placed on an entirely new plane, and the war conditions had uprooted many of their former theories and had in various ways upset their normal business practice. The associated companies had encouraged their employés to enlist for service during the war, although the drain upon the personnel had led in some cases to a reduction of the services, and in nearly all cases to difficulty in operating the undertakings. Altogether about 2,500 of their employés were now serving in the Forces, and of the head office staff alone about 60 young men, including several secretaries, had gone to the Front. One effect of the war was an all round increase in wages, which was a serious matter to the associated companies, as they were unable to obtain compensation by raising fares or increasing the price of their electricity. In the case of the Brush Company the increase in wages amounted to about £12,000 per annum. He feared that the general increase in wages would produce many difficulties later. The huge destruction of fixed and circulating capital which was unavoidable in the case of war, would have to be made good by retrenchment and economy. They would all have to work harder and spend less. It would not be possible to maintain the present high level of wages, and much distress he feared would follow. However, those were difficulties of the future, and the best way of meeting them was to deal effectively with present difficulties. As far as the particular industries in which that company was concerned he saw no reason to be pessimistic, for he felt sure that when the war was concluded, local authorities and others who had electrical contracts to place would not again be so unwise as to place them in Germany for the sake of a slight advantage in price. Therefore despite present and future anxieties he looked forward with confidence to their being able to maintain the position they had attained and the progress they were making. Of course in the present conditions they were not starting any new enterprises, except such as were necessitated by the war. All capital expenditure, however, could not be suspended by public service undertakings, whose gradual growth was the law of their existence. Several of their associated companies had therefore obtained Treasury consents for issues of capital, some of which had already been successfully made. In regard to the accounts, their investments on undertakings stood at £4,771,842, or nearly £100,000 more than in the preceding balance sheet, and on that larger amount the average yield had been 4.55 per cent., as compared with 4.47 per cent. last year. They could well understand that the yield would have been better had it not been for the war. In spite of the adverse conditions they had sold investments of the book value of £59,379 at a net loss of only £117. Proceeding to explain the position in regard to the scheme for the re-arrangement of the capital, the Chairman said they could not ignore the fact that the interests of the preference stockholders and those of the ordinary shareholders were not identical. They submitted the scheme last year to the stockholders and asked for their views upon it, and the replies they had received showed unmistakably that the majority considered the scheme fair and equitable to all parties. As a result of discussions, however, a few small modifications had been suggested which the directors were willing to adopt. At present there were two classes of preference stock and two classes of ordinary, and there were the income certificates; and all the stocks behind the debentures ranked equally as regarded capital. The total capital was £2,947,380 besides £266,371 income certificates. The net effect of the proposal was to write down the capital by £908,372 and to divide it into two classes only, viz., 6 per cent. cumulative participating preference stock with priority as to capital, and ordinary stock ranking after the preference as to capital and dividends. The preference stock would be issued to the holders of the existing 6 per cent. preference stock, who would receive the same amount in new stock as they held at present. Holders of the present 7 per cent. non-cumulative preference stock would receive 35 per cent. of their present holdings in new preference stock, and the holders of the income certificates would receive 10 per cent. of their present holdings in new preference stock. Of the new ordinary stock there would be issued to the holders of the present 7 per cent. non-cumulative preference stock, 65 per cent. of their present holdings, making with the 35 per cent. which they would receive in new preference stock 100 per cent., equal to the amount of their present holdings. The present preference stock holders were not asked to bear any portion of the reduction of capital, which fell entirely upon the ordinary stockholders. The holders of the existing 6 per cent. preferred ordinary stock would receive 50 per cent. of their present holding in new ordinary stock, and the holders of the existing deferred ordinary stock would receive 30 per cent. of their present holdings in new ordinary stock. The holders of the income certificates would receive 25 per cent. of their holding in new ordinary stock, making with the 10 per cent. in new preference stock, 35 per cent. of their present holdings. It might be thought by some that the scheme ought to be postponed because of the uncertainties of the future, but the directors did not take that view. They did not think that the war would materially affect the capital values of their undertakings. The estimate of dividends which he submitted last year showed that after the re-arrangement they should be able to pay 4 per cent. per annum on the new ordinary stock and increase the dividends steadily in future years. He saw no reason to revise that estimate now, and he hoped no circumstances would arise which would necessitate a reduction in the estimate, but the directors were anxious to have it understood that during the war and during the strenuous times that would follow after, the distribution of profits should not be looked upon as a thing that could be done without regard to the general situation and the permanent interests of the company. It was quite possible that if the war was prolonged the Government embargo on the issue of new capital might become even more stringent than it already was, and it was quite conceivable that the companies in which they were interested might find it prudent and necessary to employ their cash resources for more pressing needs than the payment of dividends. They fully recognised that the payment of dividends was the ultimate object of all their work, but it was impossible to say what situation this war might produce, and it was only right that he should, without in any way alarming the stockholders, utter that word of warning at a time when they were proposing to reduce the capital and were raising expectations of larger dividends.

Mr. C. SHIRREFF HILTON seconded the motion which, after a brief discussion, was agreed to.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended May 28th, 1915, amounted to 1,904,829, compared with 1,425,593 units in the corresponding four weeks of 1914.

National Electric Construction Co., Ltd.

THE annual meeting was held on June 24th at 3, Laurence Pountney Hill, E.C. Mr. L. B. SCHLESINGER, who presided, said that the negotiations for the contract in Denmark which had been in hand for some time had been suspended on account of the war, and the contract in connection with the Bagdad scheme was for the time being in what he hoped might be called a state of suspended animation. Owing to the Treasury restrictions, he was afraid that finance during the period of the war would be practically impossible. Provisional Orders granted by the Board of Trade for the electric lighting of districts contained a clause to the effect that the Order was to commence to run from a date to be fixed by the Board of Trade after peace had been declared, and he believed that practically all Acts of Parliament for tramway extensions, etc., prohibited the raising of capital for a period of twelve months after peace had been declared. In consequence, there would be little general contract work to be secured. They were endeavouring to secure construction work from other channels, and he thought their efforts would be successful. They had an arrangement with the operating companies controlled by the Electrical Finance & Securities Co., Ltd., whereby they carried out the construction work and, in addition, supplied the materials so long as they could supply at prices not unfavourable to the company. When the war was over he thought they could look forward to a constant flow of construction work from that company. Proceeding to refer to the various undertakings in which the company was interested, he said the war had affected their progress, with two exceptions. In addition to decreased revenue they had had to face increased expenditure owing to dearer coal and materials, and war bonuses and payments to dependents of the employés who had enlisted and whose positions were promised to be kept open. The revenue of the Rhondda Tramways Co. up to the date the war broke out showed an increase of £2,095 over the corresponding period of 1913, but since then there had been a decrease, so that by the end of the year the increase was reduced to £566. There was a decrease this year up to date of £1,760, as against the corresponding period of last year, the average decrease being £72 per week. That was likely to continue, although probably from August to the end of the year the decrease would not be so noticeable. The railless traction system which was opened in the district towards the end of last year was suspended in March owing to the condition of the roads and was not yet working. He understood, however, that they would be in a position to resume the service shortly, although owing to the decreased population they could not expect to obtain the results which they would get in normal times. The profit earned for 1914 was £8,190, which with £593 brought forward made a total of £8,783. £2,000 had been put to reserve and renewals account, and the balance of £6,783, which was more than sufficient to have paid the full dividend on the preference shares, had been carried forward. The results of the Torquay tramways for the first half of the year appeared to forecast further increases in revenue and profit, but with the outbreak of war all holiday traffic ceased, and during the two months of August and September there was a decrease in the revenue of £3,786 as compared with 1913. It was satisfactory, therefore, that the company should have been able to pay a dividend of 3¼ per cent. on the ordinary shares after providing for reserve and depreciation on the same scale as in prevous years. There was a decrease in receipts to the 20th inst. of £512, as compared with the same period last year, although the estimated decrease in profit was negligible. The directors were, however, inclined to believe that the results for the current year would be worse than those for 1914. In regard to the Dewsbury and Ossett tramways, after providing for sinking fund and interest payments to the local authorities, a profit of £1,188 was earned, a decrease of about £399. For the current year, up to date the receipts showed an increase of £320. In the case of the Mexborough and Swinton Tramways Co., notwithstanding the war, the profits for the year amounted to £6,930, compared with £6,460 in 1913, which permitted of the payment of a dividend of 2¾ per cent., as against 2½ per cent. last year. The new 300-KW. steam turbine set was started working in June, 1914, and during the period it was running there was a very substantial reduction in costs. A breakdown occurred in February last, and owing to the difficulty experienced by the manufacturers in getting the material necessary for the repairs the turbine was still out of service. In the case of the Musselburgh and District Electric Light & Traction Co., there was again a satisfactory increase in the profit, which amounted to £7,547 as compared with £7,169 in 1913, and £5,901 in 1912. The results for the current year, however, had been seriously affected, first, by a strike of the company's employés, which lasted about a month; and secondly, by the war. Musselburgh was on the Firth of Forth, and the lighting restrictions were particularly severe. However, he thought that when the war was over the results for the past two or three years predicted steady progress. The results in the case of the City of Oxford Tramways Co. were very gratifying. For the year 1914, after providing for depreciation on a generous scale, there was a balance sufficient to pay a 4 per cent. dividend. The directors, however, only paid 2 per cent., carrying forward the balance. At Bo'ness, Carnarvon, and Wisbech, the military restrictions as to lighting were very severe, and the undertakings there had suffered severely, although at Bo'ness, owing to the increased demand for power, since the close of the year there had been a substantial improvement, and it looked as if the works would have to be extended. The net result of the year was that there was a balance of £1,675 carried to the credit of profit and loss, as compared with £174 for 1913, and after providing £1,550 for the debenture redemption fund there was a balance of £125 to be carried forward. Had it not been for the war the outlook was distinctly more promising than it had been for some time past, but with all the undertakings in which they were interested, affected as they were, and the financial restrictions imposed by the Treasury, they must be satisfied if they could make both ends meet for the time being.

Mr. J. T. JERVIS seconded the motion, and the report was adopted.

Marconi International Marine Communication Co., Ltd.

IN their report for 1914 the directors state that during the last five months of the year the company's business suffered considerable disorganisation and some loss, due to the war entailing a great increase of work and strain upon those responsible for the conduct of the business, but, notwithstanding the adverse circumstances, the business had continued to show substantial progress. The net profit was £55,668, after deducting £28,000 for depreciation and debenture interest, compared with a net profit of £37,029 for the preceding year. The revenue from ships' telegrams, subsidies, etc., amounted to £175,021, which was a substantial increase over the amount for 1913, namely, £146,317.

The number of telegraph stations owned and worked by the company as public telegraph stations on the high seas increased from 788 at the end of 1913 to 965 at the end of 1914. Although these figures denote a marked appreciation of the company's organisation, the increase would have been even more satisfactory had normal conditions prevailed. During the current year further progress is being made, the number of steamers fitted to June 19th having increased to 970.

The fact that there are now over 2,000 ships, exclusive of ships of war, fitted with Marconi telegraph stations, and for the most part worked under the direction of this company and its associated companies, has an importance in these times which all shareholders will appreciate.

The Amalgamated Wireless (Australasia), Ltd., in which this company is interested, has paid a dividend of 4 per cent. in respect of the period to June 30th, 1914, and an interim dividend of 2½ per cent. in respect of the half-year ending December 31st, 1914.

The amount to the credit of profit and loss account now stands at £64,856, including £6,068 brought forward. The directors recommend a final dividend for 1914 of 5 per cent., which, with the interim dividend, makes 10 per cent. for the year.

The company has sustained some loss in consequence of the attacks upon our mercantile fleet by enemy submarines, for which it is contemplated compensation will be received. However, the directors think it desirable that £10,000, a sum far in excess of all losses to date, should, in the meantime, be placed to the credit of a special reserve account, and having regard to the prevailing circumstances and the desirability of their holding a strong financial position, with ample cash resources to provide for the continuous increase of telegraph installations on board ships, it is deemed prudent to carry forward £20,747, after allocating £3,500 to the repayment of debenture account.

The option on the 43,916 unissued shares of the company for two years from June 27th, 1913, mentioned in the last report, has not been exercised.

The directors record the death of two of their colleagues, General Albert Thys, of Brussels, and Major Samuel Flood Page.

Annual meeting: July 7th.

Edmundsons' Electricity Corporation, Ltd.

THE net profit for the year ended March 31st, 1915, after providing for administration expenses and for mortgage and debenture stock interest and redemption, amounts to £23,240. After adding £2,125 brought forward and deducting the interim half-yearly dividend paid in January last on the cum. pref. shares, the final half-yearly dividend on the cum. pref. shares requires £6,000, and £3,366 is to be carried forward. For the previous year the net profit was £23,125. There was carried to reserve £9,000.

We extract the following particulars from the schedule showing the gross profits of subsidiary and other companies for the years 1913 and 1914:—

	Gross profit (before providing for capital charges and depreciation). 1914.	1913.	Lamps connected (equiv. 33-watt). 1914.	1913.
Alderley	£3,118	£2,849	31,390	27,823
Bromley	12,755	13,196	122,671	115,518
Folkestone ..	19,487	17,994	145,943	139,100
Guernsey ..	5,830	5,895	135,471	126,774
Isle of Wight ..	12,946	14,402	145,794	133,809
Ilfracombe ..	1,151	1,252	22,550	21,159
Lymington ..	1,*99	2,058	21,085	20,*94
Melton Mowbray ..	2,727	2,654	25,152	23,206
Newmarket ..	2,318	2,630	30,749	29,729
North of Scotland ..	6,937	7,075	95,089	87,570
Ramsgate ..	3,991	3,*92	44,459	40,478
Scarboro' Trams ..	298	730	—	—
Salisbury ..	5,896	5,783	44,576	43,881
Urban Co. ..	70,329	61,*84	836,519	760,319
Wycombe ..	6,337	6,242	68,336	65,250
Cromer	892	1,109	17,806	16,828
Dorking	2,393	2,643	26,*95	24,141
Frome	2,063	1,446	51,820	48,991
Hamilton ..	4,300	3,640	78,898	67,368
Surbiton	*3,938	*4,254	*49,943	*47,313
	£169,605	£161,*28	1,994,926	1,839,651

* Figures for year ended March 31st.

The total capital expenditure increased during 1914 from £3,098,053 to £3,182,877.

Annual meeting: July 8th.

Crompton & Co., Ltd.

IN their report to March 31st, the directors state that the reorganisation of the company's business and management continues to show beneficial results, and, with economies in manufacture, accounts for the improvement in the year's working. The gross profit for the year is £57,911. After deducting general charges, depreciation, interest on debentures and other items, there remains, with the sum carried forward, an available balance of £28,649. The directors recommend that there be placed to general reserve fund £6,500, to special depreciation account £3,500, written off preliminary expenses £1,608, that a dividend be paid on the preference shares at the rate of 7 per cent. per annum, requiring £9,349, leaving £7,691 to be carried forward. The company's works continue to be fully employed.

Annual meeting: July 5th.

For the previous year the gross profit was £48,672. There was placed to general reserve £2,500, written off preliminary expenses £1,500, a dividend of 5 per cent. was paid on the preference shares, and £2,189 was carried forward.

J. G. White & Co., Ltd.

THE annual meeting was held on Tuesday at the Cannon Street Hotel, E.C. Mr. J. B. WHITE, who presided, said that when they met a year ago, a month before the outbreak of war, emphasis was laid on the depressed financial conditions then existing, and it was pointed out that the resources of the company were less liquid than they would have wished, also that new contracts were not being received as fast as old ones were being completed. The directors, nevertheless, anticipated a moderately good year. The effect of the war had been very serious, but considering the character of the business, and being as they were largely dependent for additional contracts on the development of new enterprises, they were to be congratulated on being able to meet under as favourable conditions for the company as were shown by the accounts. When the war began the necessity of doing everything possible to conserve their resources became at once evident. If the company was to withstand a possible long period of comparative inactivity, to meet promptly its commitments and obligations when, on the other hand, it might not be able to secure the payment of accounts for materials furnished and work done on all contracts in hand, then not only would it be necessary to watch carefully over the liquid resources of the company but also to institute economies wherever possible. It was for this reason that the directors decided not to pay an interim dividend at the end of December last. Economies were as early as August instituted by reducing the fixed salaries of directors and the staff. A considerable number of the staff had enlisted, but were receiving allowances and their places were being, in so far as it was possible, held open for their return. Other economies had been effected so that while the war had been in progress for seven months out of the total year covered by the accounts, yet expenses had been reduced by 32 per cent. of those for the preceding year. The expenses for the current year should show a reduction of about 50 per cent. over the year to February, 1914, and it would not seem wise to make any further reduction at the present time as it was necessary to keep the organisation complete in outline. The work in some branches, especially in the operating department which had charge of the various companies for whom they acted as managers and engineers, had been increased due to the difficulties of transportation, securing supplies, and staff. With regard to the present position, they had made a profit of £19,772, against £70,387 in the preceding year; and they were recommending a dividend of 6 per cent. If their resources had been more liquid they could have made a larger distribution. The item "percentage of profit to staff and directors," which last year absorbed £7,504 had disappeared. This was unfortunate for the directors and staff interested, and showed that they were suffering with the shareholders in the lessened return. Turning to the balance sheet, there were a few changes from a year ago. On the debit side the sundry creditors had been reduced from £220,583 to £158,549. When he told them that £120,000 of this amount represented a loan they would realise that the ordinary creditors were comparatively small representing only current accounts, which had been paid since the date of the balance sheet, although there were now, of course, similar accounts outstanding. On the credit side it would be seen that they had realised some of their investments; that had been done at a profit. The financial stability and strength of the company really depended on the investments. The directors had gone over these most carefully, and in their opinion, the value appearing in the balance sheet was less than they were actually worth to-day, although under present conditions no appreciable amounts could be sold on the market. From this fact they would appreciate that the previous valuations placed upon the securities were conservative. In connection with the sundry debtors, allowance had been made for any doubtful accounts, and while it might not be possible to collect certain of these until the end of the war, yet the directors considered that they were perfectly good and that their collection with interest would only be a matter of time. With regard to the future they believed that the business of the current year would meet all expenses and leave a substantial profit. As to anything beyond that period it was difficult to forecast, but the directors saw no reason why the company should not continue its successful career.

Mr. W. C. BURTON seconded the motion which was adopted without discussion.

Austrian Electrical Companies.

The Elektrizitats Gesellschaft Kolben & Co., of Prague, has declared a dividend of 7 per cent. for 1914 on a share capital of £250,000, being the same rate as in 1913.

The Kabelfabrik und Drahtindustrie A.G., of Vienna, earned gross profits of £109,000 in 1914, as compared with £113,000 in 1913, and net profits of £43,000 and £52,000 in the two years respectively. The dividend is at the rate of 10 per cent., as against 12 per cent. in 1913.

The Gesellschaft für Elektrische Industrie, of Vienna, which is closely associated with the Vienna Bank Verein, realised gross profits of £91,000 in 1914, as contrasted with £90,000 in the previous twelve months. After making provision for depreciation and reserve funds, the accounts indicate net profits of £8,900, as against £8,700 in 1913, and the directors recommend the distribution of 5 per cent. on the share capital of £83,000, being the same rate as in the preceding year.

The A.E.G. Union Elektrizitats Gesellschaft, of Vienna, which is a subsidiary of the Berlin A.E.G., reports that the company suffered from the effects of the war, and the difficulty of procuring raw materials, even at the greatly increased prices. The number of the staff and workmen was reduced to 70 per cent. of the normal through the call to the Colours. The production of munitions of war was undertaken in so far as was possible. As compared with the previous year, the gross profits in 1914 experienced a decrease, and the net profits also declined from £58,000 in 1913 to £26,000 last year. It has been decided to pay a dividend of 4 per cent., this rate contrasting with 8 per cent. in 1913.

French Electrical Companies.

The Compagnie Générale de Electro-Chimie de Bozet, which increased its share capital in 1914 for the purpose of doubling the productive capacity of the works, records net profits of £12,000, as against £28,000 in 1913. It is not intended to pay any dividend.

The Compagnie Continentale Edison, whose concession for the supply of one of the districts in Paris expired at the end of 1913, reports gross receipts of £33,000 for 1914, and net profits of £14,000, which sum has been carried forward to the current year.

The Compagnie Centrale d'Energie Electrique records net profits of £23,000 for 1914 on a share capital of £800,000. The profits have been carried forward, this result contrasting with a dividend of £1 per share in 1913.

The Compagnie Parisienne de Distribution d'Electricité, which took over from the several companies the whole of the lighting supply business in Paris at the beginning of 1914, proposes to pay for the first working year a dividend at the rate of 8s. per share on an ordinary share capital of £4,000,000.

The Société d'Energie Electrique du Littoral Mediterranéen, which has a share capital of £1,520,000 and loan capital of £1,420,000, proposes to pay 12s. per share for 1914, as compared with 16s. in 1913. The reduction is due to an exceptional allocation which has been made to the reserve fund.

The Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques reports net profits of £63,000 for 1914, as contrasted with £132,000 in 1913 on a share capital of £2,000,000. It is not proposed to make any distribution, this result comparing with a dividend of 12s. per share in each of the past seven years.

The Compagnie Havraise d'Energie Electrique, which has a share capital of £360,000, obtained gross receipts of £109,000 in 1914, as against £98,000 in the previous year, the great activity at Havre being responsible for the increase. After deducting the general expenses and interest on loans, the net profits are £54,000, as compared with £47,000 in 1913, and the dividend is at the rate of £1 2s. 4d. per share, as in the preceding year. It is in contemplation to raise the share capital gradually to £600,000, so as to provide for the extensions of plant which are necessary owing to the growth of the business.

The North-South Railway Co., which works the second underground electric railway in Paris, earned gross receipts of £354,000 in 1914, as against £393,000 in the previous year. On the other hand, the working expenses were £169,000, as compared with £196,000, and the profit share of the municipal council was £26,500, or £800 less than in 1913. The interest on the loan capital required a larger sum than in the preceding year. The net profits are returned at £41,000, as contrasted with £78,000 in 1913, the whole of the former amount being placed to a contingency fund.

The Paris Metropolitan Railway Co., whose working results in 1914 were seriously affected by the war, reports gross receipts amounting to £1,861,000, as compared with £2,185,000 in the preceding year. After deducting the receipts from line No. 8 (Auteuil), which was operated for the account of the City Council, there remains the sum of £1,768,000. The working expenses declined from £938,000 in 1913 to £778,000 last year, and the share of the Municipal Council from £701,000 to £572,000 in the two years respectively, but the interest service on the loans required a greater appropriation than in the previous year. The net profits amount to £252,000, as contrasted with £375,000, and the rate of dividend is 11s. 2d. per share, as against 17s. 2½d. in 1913.

Madras Electric Supply Corporation, Ltd.

MR. J. GRAY presided at the annual meeting, held at 1, Queen Victoria Street, E.C., on June 24th. He first referred to the death of Mr. T. E. Ivens, a director, and said that Mr. K. A. Scott-Moncrieff, who had experience of the working of electric lighting and power companies in India and at home, had been elected to fill the vacancy. The revenue account showed a surplus of only £315, but as this compared with a loss of £5,309 for 1913 they had made some headway in the re-arrangement of management and administration, to which this improvement was almost entirely due. However, the results were extremely disappointing. Last year he said they expected to obtain the beneficial use of the new plant during the last four or five months of the year, and this forecast was considered at the time to be fully warranted. It was October, however, before the new generating plant could be handed over by the contractors, and subsequent delays with the transformers and rotary converters prevented them from obtaining any real benefit from the new plant during the whole of 1914. The cause of these delays had been the subject of protracted discussion with the contractors and sub-contractors, but a settlement had not yet been reached. Their generating costs since the beginning of this year had been reduced by 50 per cent., and the shareholders would thus appreciate what the delay in starting the new plant had meant to them financially. Applications for current, both for lighting and power, continued to expand, and arrangements had been made for providing a supply for the districts of Adyar and Kilpauk. This side of the business was quite satisfactory, and there was still a large field remaining to develop. Last year he said the board had under consideration a proposal to increase the flat rate of 4 annas for lighting and fans, which was charged to private consumers, and it was resolved to defer a decision until he had visited Madras. This he did in January last, and having very fully discussed the subject with Mr. Simpson (the local director) and managers, a petition was presented to the Government to increase the flat rate from 4 annas to 5 annas per unit. They considered that, whether from the point of view of cost of production in Madras, where fuel was exceptionally dear, or from the charges made by other Indian electricity companies, a strong case had been made out for the increase, and they sincerely hoped Government would grant their application. If so, their revenue would be increased automatically by about £6,000 per annum, which would be of the greatest help to them during the next few years in putting the company on a sound financial basis. While he was in Madras an agreement was entered into with the Corporation for an increased supply of current for street lighting on terms which were mutually satisfactory, and they hoped to see a considerable increase in this item of revenue during the next year or two. The net revenue account, after debiting debenture interest and providing for the sinking fund, showed a debit of £11,710, which had been carried to suspense account. A comparison with 1913 would show that the loss had been apparently increased by £1,185, but he asked them to bear in mind that in 1913 the debenture sinking fund, amounting to £3,906, had not come into operation, and that that year had the benefit of an additional £3,200 for interest upon capital raised for the new installation. The comparison of the net revenue account for the two years was not, therefore, so unfavourable to 1914 as the figures alone might imply. The first four months of this year showed that they had earned sufficient to cover all interest and charges—depreciation excepted—and there was every prospect of a further improvement in the latter part of the year, provided there was no more trouble with the transformers. Additional transformers were now on their way to Madras, and their arrival about the end of next month would remove any further anxiety. Indeed, they already recognised that the concern had "turned the corner," and that they would in future meet under much more favourable auspices than they had yet done; but the hopes of the directors had been so often unfulfilled that he was anxious that they should recognise exactly how they were placed at the moment. In regard to the last three items on the asset side of the balance sheet, viz., "Cost of issue of debentures," "Discount on debentures," and "Suspense account," which aggregated £58,614, this amount could only be liquidated either gradually out of profits (which would indefinitely postpone the payment of dividends either on the preference or ordinary shares) or by writing off the amount from the share capital. In addition, the loss arising from the supersession of part of the old plant would have to be provided for. This had not yet been ascertained, but they expected to be able to appraise the amount at an early date. The board was of opinion that it was desirable to write off the whole of these losses by a reduction of capital, and it was proposed to formulate a scheme for their confirmation at the next annual meeting. While he was in Madras, extensions of the tramways were discussed and the routes were settled with the Corporation. The proposals were submitted to Government for approval, but this had not yet been obtained. He was of opinion that the extensions contemplated would prove remunerative, but there would probably be some delay in proceeding with these, although the tramway company was using every endeavour to obtain the consent of Government. He was pleased to say that he found the tramway undertaking in good condition generally. The re-organisation of the staffs of the two companies in Madras had proved beneficial, and important economies had been effected thereby. The board were indebted to the management in Madras. Mr. Simpson, the local director, notwithstanding his other important duties, took a close interest in both undertakings. The technical and commercial departments were ably supervised by Mr. Jones and Mr. Powell respectively, but a special word of commendation was due to the former and his staff for the manner they had carried on the undertaking under very arduous conditions.

Mr. J. G. R. STONE seconded the motion.

Mr. MUMFORD criticised the cost of management, and remarked that awful mistakes had been made in the past.

The CHAIRMAN replied that the costs compared favourably with those of any other concern of like dimensions that he was acquainted with. He mentioned that so far as the profit-earning side of the business was concerned, the anticipations of the original directors had been fully realised. The losses incurred by the company had arisen entirely from the excessive cost of production. The plant chosen under expert advice had proved by experience to be unsuitable and uneconomical.

The report was adopted.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List :—

Calcutta Electric Supply Corporation, Ltd.—Further issue of 6,115 ordinary shares of £5 each, fully paid, within Nos. 250,001 to 260,000; and 6,198 5 per cent. cum. pref. shares of £5 each, fully paid, within Nos. 200,001 to 210,000.

Edgar Allen & Co., Ltd.—A dividend on the ordinary shares of 10 per cent. per annum and a bonus of 2½ per cent. for the year ended March, free of tax, are recommended.

Oriental Telephone and Electric Co., Ltd.—The directors of the company are stated to have paid a bonus of 2s. 8d. per share, free of income-tax, on the ordinary shares.

Bombay Electric Supply and Tramways Co., Ltd.—The directors recommend a dividend of 6 per cent. on the ordinary shares, carrying forward £8,327.

STOCKS AND SHARES.

TUESDAY EVENING.

For the time being, all the markets of the Stock Exchange reflect the influence of the new War Loan. The cheapness of the latter has made existing securities in many cases look over-priced at their current levels, and the result, therefore, is that business in these senior stocks has come to something like a full stop, pending allotment of the War Loan and whatever subsequent consequences will spring therefrom. The easiest way to gain an idea of what the change in values set up by the new loan really means, is to work out the corresponding return which would have to be given, say, by a 4 per cent. debenture stock of some first-class company, the price of which security has hitherto stood in the neighbourhood of 95. To get on to a 4½ per cent. level, the quotation would have to go back to 89; and even then an industrial debenture would scarcely look as attractive as a national stock bearing the guarantee of the Imperial Government. It is too early to realise, even yet, how far-reaching will be the influence of the new War Loan upon existing securities; its immediate effect has been to render many scores of them unsaleable, whether they be protected by minimum prices or not.

The investor in the older stocks, of which the capital value is materially depreciated for the time being by the latest War Loan, must look not to the price of his stock, but to the safety of his interest. With that well secured, he need trouble little; and he will apply for the new security, feeling that 4½ per cent. is an excellent return for a patriotic stock, backed by the greatest security in the world. The new loan can be repaid in ten years' time at 100, and, in any case, must be so redeemed by 1945. Therefore it stands to reason that the price will never go to an extravagant premium; and this terminability of the stock, while offering an extra inducement to the investor of to-day, is a businesslike compensation to holders of existing securities, the prices of which are temporarily depressed by the War Loan, but which, by reason of their longer life, stand in a far better position for improvement in price in the years to come.

The War Loan has altered the whole standard of values, it is true; but too much stress must not be laid upon this, since it may prove to be in the nature only of a temporary depression. There is nothing fantastic in the longer view which looks ahead and sees, after the declaration of peace and the settlement of the new conditions which will follow it in the commercial, labour, and financial worlds, a return to years of profound peace and cheap money, in the course of which the present War Loan, paid off at par, will no longer compete with gilt-edged securities demanded by the investor. Between the prices of that time and those of to-day there may quite probably stretch a long ladder of which the foot rests upon to-day's war markets; and without pursuing the metaphor any farther, let us come back to the point from which we started, namely: that assurance of dividend payments is to-day of far greater value than quotations for the stocks yielding them—these quotations being influenced by factors which in the long run will automatically cease.

We have ventured to discuss this general aspect of the situation because it has a very vital bearing upon the securities

with which these notes are mainly concerned. It is not our province to deal with speculative concerns at all; and although in the electrical industry, as in every other, there are stocks and shares of more or less speculative character, they do not invite speculation in the sense of that which goes on in mining shares, for instance, or American railroads.

The necessity for raising such a huge sum, in connection with the war requirements of ourselves and our allies, has produced a War Loan of so much greater magnitude than has ever before appeared that its coming was bound to cause radical alterations to all past and conservative views regarding investment. This alteration has been accompanied by—or, rather, has produced—a great deal of uneasiness, possibly anxiety, in the minds of the great investing classes. The anxiety is superfluous in most cases; and as soon as the subscription lists are closed, the existing prices modified to fall into line with the new standard of values set up by the War Loan, and comparative familiarity with the War Loan has shown how extremely cheap is the stock itself, the nervousness will subside. The boldness of our sons in thronging in their thousands to the Services shall be emulated in its humbler degree by the calmness with which we regard the cutting off slices from our material possessions in the great cause.

From the foregoing, it may be well supposed that the changes on the week will be most marked in the higher-class investments stocks. Up to the present, the ordinary and preference issues have not had time to become adjusted to the fresh standard referred to above, but 4 per cent. debenture stocks are being scaled down drastically. Eastern Extension debenture and Eastern Telegraph debenture are two representative stocks which may be cited, the falls being 5 and 10 respectively. Nor is it possible to say that even at the lower prices would buyers be found. Great Northern Telegraphs stand out brightly, credited with £1 rise. American Marconis rose to 12s. 6d. on New York demand, and Marconi Marines hardened to 1 3/16 on the good report just out.

The Home Railway market has suffered severely, having its especial cause for weakness in the latest demands made by the miners, which have led to their being allowed to remain outside the area controlled by the Munitions Workers' Act, and apparently left to make whatever insatiable demands may please them. The stocks of the Steam companies have already undergone heavy losses, while Underground Electric Incomes are down 4½ points to 69, at which the yield, allowing for the payment of the interest free of tax, comes to nearly 10 per cent. on the money so long as it is maintained.

The Electric Lighting list shows the debenture stocks to have fallen in much the same way as those in the Telegraph department. Declines of 2 to 8 points are marked, and one cannot say that the end of the shrinkage can be limited by the present prices. Losses amongst the ordinary and preference are less drastic, but in these cases we have to add that the levels are once more to a large extent nominal.

Curiosity and interest both were aroused in the Stock Exchange last week by the marking of a bargain in South Metropolitan Electric ordinary shares at 18s. 6d., accompanied by the two symbols which point out the transaction as having been amongst exceptional bargains, and done with, or between, non-members. Seeing that other transactions were marked on the same day at 14s. 9d. and 15s. 3d., and that more shares could probably have been obtained, at any rate at 16s., the price of 18s. 6d. naturally created attention and inquisitive wonder why a buyer should have paid such a price, unless under very exceptional circumstances indeed.

Brazil Tractions have gone back to 50; and the Foreign group, with most of the other Stock Exchange markets, is lower. Mexican Light preferred shed 9 points, Mexico Trams 5 per cent. bonds lost 3, on the latest information from the country, to the effect that chaos is, if anything, worse than ever. A pitiable story was unfolded the other day at the meeting of the Mexican Railway Co., and there seems hardly a gleam of light on the situation, except such as is provided by the hope, so often raised, that the United States Government will endeavour to restore peace—though, when peace comes, there will be a vast amount of reconstruction work to be done in Mexico before ever the dolorous country is likely to return interest to its creditors.

Several reports of interest are out this week. Cromptons have done well, practically doubling the net profit of the previous twelve months and paying 7 per cent. on the preference capital—an increase of 2 per cent. as compared with last year. The Bombay Electric Supply & Tramways Co. issues a decidedly good report. The ordinary dividend, as before noticed, is a repetition of the usual 6 per cent.; but the carry-forward of £8,300 is £4,300 more than it was a year ago. The Oriental Telephone & Electric Co. has declared a bonus of 2s. 8d. per share, free of tax, on its ordinary shares; and the proprietors must hold themselves indeed fortunate in getting such a pleasant solatium at a time like this.

There is not much doing in industrial descriptions. Most of the changes are, of course, in a downward direction. Armament shares have given way, in connection with the Government's Bill for taxing war profits. The rubber market is quiet, its volume of business greatly curtailed by the exclusion of most other things except the War Loan from the minds of investors. Rubber has again hardened to half-a-crown per lb. Amongst the few bright spots, copper shares claim notice, their prices being well maintained, in consequence of the strength of the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price June 29, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8½	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. do. 4½ Pref.	4½	4½	—	5 9 1
do. do. City Pref.	4½	3⅞ xd	—	5 16 2
do. 4 Deb.	4	82	−8	4 17 7
Chelsea	5	4½	− ⅛	5 11 1
do. 4½ Deb.	4½	88 xd	−2	4 17 10
City of London	9	13½	− ¼	6 11 0
do. do. 6 per cent. Pref.	6	12	—	5 0 0
do. do. 5 Deb.	5	105 xd	− 2½	4 15 8
do. do. 4½ Deb.	4½	90 xd	−4	5 0 0
County of London	7	11	− ⅜	6 7 3
do. do. 6 per cent. Pref.	6	11	− ½	5 9 1
do. do. 1st Deb.	4½	96 xd	−2	4 13 6
do. do. 2nd Deb.	4½	90	−5	5 0 0
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1⅜	− ⅛	8 8 4
do. do. 6 per cent. Pref.	6	4½	− ⅛	6 3 1
do. do. 4 Deb.	4	85	−2	4 14 2
Metropolitan	8½	8	—	5 16 8
do. 4½ per cent. Pref.	4½	3⅞ xd	—	6 0 0
do. 4½ Deb.	4½	90 xd	−2	5 0 0
do. 3½ Deb.	3½	70 xd	−2	5 0 0
St. James' and Pall Mall	10	7½	− ½	6 18 0
do. do. do. 7 per cent. Pref.	7	6½	− ½	5 12 0
do. do. do. 3½ Deb.	3½	70 xd	−3	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	− ¼	6 8 7
do. 4½ Pref.	4½	4⅜	—	4 14 9
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	103½	−2	5 16 0
do. Def.	1½	22	− ½	6 16 4
Chile Telephone	8	6⅜	—	5 18 5
Cuba Sub. Ord.	5	8½	—	5 17 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12	− ⅜	*6 18 4
do. 4 Deb.	4	82½	−5	4 17 0
Eastern Tel. Ord.	7	130	−1	*6 1 9
do. 8½ Pref.	8½	72	−8½	4 17 3
do. 4 Deb.	4	81	−10	4 18 9
Globe Tel. and T. Ord.	6	10⅜ xd	—	*6 7 6
do. Pref.	6	11¼ xd	—	5 6 8
Gt. Northern Tel.	22	34	+1	6 9 5
Indo-European	65/-	52	−2	6 5 0
Marconi	20	1⅜	—	11 0 8
New York Tel. 4½	4½	96⅛	− ⅛	4 13 0
Oriental Telephone Ord.	10	2 x i	—	5 0 0
do. Pref.	6	1⅜	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 3
United R. Plate Tel.	8	6⅞	− ⅛	*7 15 6
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	1⅛	− ⅛	8 17 9
Western Telegraph	7	18¼	—	*6 0 9
do. 4 Deb.	4	83	−7	4 16 5
Home Rails.				
Central London, Ord. Assented	4	74	−1	5 8 1
Metropolitan	1½	25	−2½	4 16 2
do. District	Nil	13	−1½	Nil
Underground Electric Ordinary	Nil	1⅛	− ⅛	Nil
do. do. "A"	Nil	4 6	—	Nil
do. do. Income	6	69	−4½	*9 18 8
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	4⅛ xd	− ⅛	6 9 5
do. 2nd Pref.	5½	8⅜ xd	—	7 11 9
do. 4 Deb.	4	80 xd	−3½	5 0 0
do. 4½ Deb.	4½	82 xd	−3	5 9 9
do. 5 Deb.	5	93	−3½	5 15 7
Brazil Tractions	6	50	−1½	12 0 0
Bombay Electric Pref.	6	10½	− ⅛	5 16 10
do. 4½ Deb.	4½	90 xd	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	50	−3	Nil
do. 6 per cent. Bonds	—	80	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	39	−9	Nil
do. 1st Bonds	—	45	−3	—
Adelaide Sup. 6 per cent. Pref.	6	5	− 7/8	6 0 0
do. 5 Deb.	5	100	−9	5 0 0
Manufacturing Companies.				
Babcock & Wilcox	14	2⅜	− ⅛	5 18 0
British Aluminium Ord.	5	22/-	—	4 12 0
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	11	− ¼	6 13 4
do. Pref.	6	6⅛	—	5 0 0
British Westinghouse Pref.	7½	1⅛	—	8 0 0
do. 4 Deb.	4	70 xd	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11½	− ⅜	6 10 5
do. 5 Pref.	5	5	—	5 0 0
do. 4½ Deb.	4½	95	−3	4 14 9
Castner-Kellner	15	8½	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	− 1/-	Nil
do. do. fully paid	Nil	19	− ⅛	Nil
do. do. 4 Deb.	4	60 xd	−1	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	18/6 xd	—	8 17 10
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	9⅞ xd	—	6 3 1
Henley	20	14	− ½	*8 3 3
do. 4½ Pref.	4½	4⅜	− ⅛	4 14 9
do. 4½ Deb.	4½	95	−2	4 14 9
India-Rubber	5	8⅞	—	5 14 3
Telegraph Con.	20	86½	− ½	6 11 7

* Allowance made for dividends being paid free of income-tax.

Kaministiquia Power Co., Ltd.—The directors have declared a dividend of 1½ per cent., or at the rate of 6 per cent. per annum, on the common stock for the quarter to July 31st.

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

The Use of Electric Vehicles in Municipal Service.

(*Concluded from Vol. 76, page 906.*)

AMBULANCE WORK.

By reason of its smooth and silent running, and uniform and jerkless acceleration, the electric is an ideal vehicle for ambulance work in our towns and cities. It has for some time been employed for this purpose by the City of London Corporation, by the Port of London Authority, and the Metropolitan Asylums Board. The feature of economy should not be forgotten; while the promptitude with which calls may be answered is just as valuable an attribute as in the case of fire brigade service. The simplicity of operation also enables several ordinary attendants to be trained to drive, so that a call may never find the van in want of a driver.

In regard to the City Police ambulances, Captain Sir J. W. Nott-Bower, the Commissioner of Police, informs the Committee as follows:—

"The electric motor ambulance service was commenced in May, 1907, with one electric ambulance. In May, 1909, a second ambulance was obtained, and both have since proved very satisfactory indeed for removing cases of accident or illness in the streets to hospitals.

"The initial cost of the ambulances, with surgical fittings, was, approximately, £569 and £552 respectively, and the total cost of the service is, approximately, £2,000 per annum.

"The cost of working is about 5.1d. per car mile, including expenses such as tires, necessary repairs to cars, charging of batteries, etc., but excluding wages and rent. Tire costs account for about 2½d. in the cost mentioned per mile.

"Another ambulance is now being obtained from the Cedes Electric Traction Co., Ltd., and will be taken into use shortly."

The Secretary of the Port of London Authority states that: "The Authority possesses four electric motor ambulances, and these have been in use since September, 1912. They have been found quite suitable for the conveyance of injured persons to hospital with promptitude and comfort."

Electric appliances are also in use in the United States. The New York Hospital, for example, has seven such vehicles. These vehicles sometimes make long journeys, it being recorded that one of them made a trip of fifty miles there and back to a hospital beyond the city limits on a stormy day, with mud, in some places, nearly up to the hubs, and it is added that only an hour's boosting charge was necessary in order to get the car home. The superintendent of one of the branches of the hospital, where they keep two horse-drawn and one electric ambulances, thus reports as to experience with this type of vehicle: "We find the electric vehicle much more satisfactory than the horse-drawn ones, especially during the hot weather. During one hot day about eighty calls were answered, and the electric ambulance responded to those with the longest radius, answering thirty calls in twenty-four hours."

FIRE BRIGADE WORK.

Electric battery vehicles have been in use to a considerable extent for fire brigade work. Notable examples of their use are to be found in London and Liverpool; while, up to the outbreak of war, they were known to be employed in several Continental cities, one having no less than 24 in use. Several towns and cities in the United States employ electrically-propelled fire engines and escapes, and there can be but little doubt that electric battery traction offers special advantages for fire brigade work, which may be summarised as follows:—

Unlike the petrol-driven type, there is no preliminary starting of the engine before the vehicle itself can be got on to the move. All that is necessary with the electrically-driven type is for the driver to get on the seat, throw off his brake, move the controller, and the vehicle is under way. That this feature secures a promptness in answering calls is fully confirmed by the experience of the London Fire Brigade, which possesses a total of 15 electrically propelled vehicles, the oldest having been put into commission in 1911.

At a discussion upon electric vehicles at the Institution of Electrical Engineers on March 19th, 1914, Lieutenant-Commander Sladen, R.N., Chief Officer of the London Fire Brigade, referring to the feature mentioned above, said:—

"Among the advantages of electric vehicles for fire brigade work, we find that they require repairing less frequently, and that the rapidity of turn-out is absolutely unequalled by any other form of traction; it is not uncommon at an electric-motor fire station, under ordinary service conditions, for a turn-out to be effected in 7 or 8 seconds, whereas with other forms of motors a good turn-out is perhaps 15 seconds. That is a very good point with us, especially for the life-saving appliances . . . . the maximum speed is at once obtained, whereas with other forms of traction, namely, steam and petrol, a little time has to elapse before things become quite normal."

The Liverpool Brigade has had 4 electric vehicles in use since 1907. Three of them weigh about 6 tons, while the fourth scales 2½ tons; all four have a speed of 20 miles per hour on the level, and a mileage capacity on one charge of 30. Mr. Alex. W. Weir, the Chief Superintendent of the Brigade, writes in regard to these vehicles:—"They have given every satisfaction, and are inexpensive to run, the cost working out at 2½d. per mile. The main features which commend this class of machine for fire brigade work are the practically instantaneous starting; rareness of failure on the road; the ease with which defects may be remedied in consequence of the fewness of the working parts; the ease with which the vehicle may be driven, and the short time in which a man can be taught to drive."

The mechanism being so simple and the construction so strong, there is much less to get out of order than in any other mechanical system of traction.

The Chief Engineer of the Philadelphia Fire Brigade, which possesses some electrically-driven engines, thus deals with the reliability feature:—"During the winter, and at times when the snow was unusually heavy, and particularly during the time when traffic between the cities of New York and Philadelphia on all the railroads was held up, this apparatus performed its duty without fail, and in one instance it was taken to a fire hydrant, where it was impossible to get with a lighter steamer with horses."

Referring to a couple of electric hose wagons which they possess, he says:—"They were run about the city during last winter's heaviest snowstorms, and fully demonstrated their ability to do all that is claimed for them, *i.e.*, not to be stalled in 12 inches of snow."

He later goes on to say:—"In the heaviest snowstorm of last winter (1913-14), Sunday, Feb. 15th, we had three police patrol petrol cars that had to be abandoned in the streets on that night. They were towed to their respective stations by electric vehicles the next morning, after the failure of two heavy petrol vehicles to move them."

At Baltimore, the Chief of the Fire Brigade affirms that their No. 32 steam fire engine, fitted for electric traction—the only one so far converted—"is the most reliable and economical apparatus in the whole department, and is always to be depended upon."

Speaking upon this point and others, Lieutenant-Commander Sladen at the previously-referred-to discussion in London last year, said:—"In conclusion, I should like to say that after four years' experience I agree with Mr. Ayton as to the advantages of the electric over other power-driven vehicles in regard to its simplicity of construction, its low cost of maintenance, its ease of driving, and its general reliability."

In regard to economy in the cost of operation, the claims of the electric on this score are fully borne out when applied to this special sort of service.

Lieutenant-Commander Sladen, speaking upon this point, stated that, in the London Brigade, the electrically-propelled appliances cost, on the average, about 1s. per mile to maintain, this figure not including drivers' wages, capital charges or depreciation, whereas the similar figure for the brigade's petrol vehicles is 1s. 3d. He also went on to say:—"When one takes into account the first cost and the depreciation, the cost of maintenance of an electric fire-escape and of a petrol fire-escape are about the same, namely, about £150 a year, allowing for interest and depreciation. The annual cost of repairs for an electric escape van that runs about 800 miles per annum is £40, that is, allowing for renewals of batteries and so forth." Viewed from the standpoint of the ordinary user of commercial motor vehicles, the costs per mile given above would be considered very high indeed, but it must be remembered that the total annual mileage run by each vehicle is comparatively small, although the vehicle has to be kept in readiness to go out at any moment.

Further information supplied to the Committee in May of this year shows that the cost of repairs to accumulators for the previous twelve months worked out at an average price of £22 per vehicle, including a complete renewal of one battery and extensive replacements to three others.

As to speed, vehicles for this purpose have been built to run up to 30 miles per hour, and have, of course, a correspondingly smaller radius of action on one charge, usually from 30 to 35 miles. The vehicles of the London Brigade can run up to 27 miles per hour on the level, while up a gradient of 1 in 19 the speed is 15 miles per hour.

Other advantages connected with the employment of electrics for fire apparatus include less room taken up in the station, greater cleanliness, and greatly reduced risk of fire. There is also the point that any ordinary fireman can be taught to drive.

No difficulty has been experienced in converting horse-drawn steam fire engines and other fire-fighting apparatus, the application of the front wheel drive, to which the electric motor so readily lends itself, making the problem quite an easy one. This method of driving is also claimed to have the further advantage of avoiding the risk of skidding to a considerable extent.

UPKEEP AND CLEANING OF STREETS.

If the dumping ground for the disposal of road sweepings is some distance from the centre of the town, much time is wasted upon the "to and fro" journeys with the ordinary cart and horse, so that, in many cases, there would appear to be good reason for the employment of self-propelled vehicles of large capacity for this class of work. Since this service entails frequent starting and stopping, the conditions are more or less similar to those appertaining to the collection of house

Some Views of the Electric Vehicles on the Victoria Embankment.

List of Vehicle Exhibits.

Exhibited by	Type of vehicle.	Carrying capacity.	Speed on smooth level road. M.P.H.	Battery.			Reference letter for method of control.	Transmission and tires.
				Make.	No. of cells.	Capacity in A.H.		
Harrods, Ltd.	Walker covered delivery van	10 cwt.	14	Edison	60	220	B	Spur and idler gear in rear wheels (solid tires)
West Ham Corporation	Open body wagon	20 ,,	11/12	,,	60	225	B	Chain drive (solid)
St. Marylebone Council	"Opel" covered delivery van	10 ,,	12	Hart, lead	52	120	A	,, ,, (pneumatic)
General Vehicle Co., Ltd.	Covered delivery van	9 ,,	15	Ironclad-exide	44	133	—	Worm drive live axle (solid)
Edison Accumulators, Ltd.	Patent automatic tipping refuse van	40 ,,	12/13	Edison	60	300	C	Bevel gear jack shaft and roller chains to rear wheels (solid)
,, ,, ,,	Type G.M. Edison chassis	20 or 40 cwt.	12/13	,,	60	225 or 300	C	,, ,, (solid)
J. Pullar & Sons, Ltd. (Perth)	Covered delivery van	20 cwt.	12	,,	60	300	C	,, ,, (solid)
Wolseley Motors, Ltd.	Baker chassis with box van body	20 ,,	10½	Ironclad-exide	42	157	—	Chain drive (solid)
,, ,, ,,	Baker chassis	40 ,,	9	,,	42	189	—	,, ,, (solid)
Croydon Corporation	Roadster passenger car	3 people	18/20	Edison	60	150	B	Worm drive live axle (pneumatic)
Poplar Borough Council	"Opel" covered delivery van	10 cwt.	12	E.P.S. Co.	44	125	A	Chain drive (pneumatic)
Heston and Isleworth Council	"Opel" light delivery van	15 ,,	14	Hart, lead	44	120	A	,, ,, (pneumatic)
Hertford St. Motor Co., Ltd.	Electric landau-lette	4 people	15/20	Lead plate	45	150	D	Helical gear (pneumatic)
Krieger Electric Carriage Syndicate	,, ,,	4 ,,	20	Naylor, lead	46	175	E	Single reduction spur gear (pneumatic)
Heath's Garage, Ltd., Birmingham	"Millburn" coupé	4 ,,	20	Philadelphia lead	20	204	—	Worm drive live axle (pneumatic)
,, ,, ,,	"Lang" coupé	4 ,,	24	Ironclad-exide	41	137 5	—	,, ,, (pneumatic)
Wolseley Motors, Ltd.	Baker electric lorry	70 cwt.	8/9	Ironclad-exide	42	—	—	Chain drive (solid)

(A). Series-parallel arrangement of battery in two sections with resistance steps. (B). As A, but with addition of series-parallel arrangement of field coils. (C). Battery in series with series-parallel arrangement of field coils combined with resistance steps in main circuit and arrangement for shunting field coils. (D). Double-wound armature and two commutators. Battery permanently in series. Series-parallel arrangement of armature windings and field coils combined with resistance steps. (E). 1st step: Two sections of battery in parallel and two compound motors in series; 2nd step: Same as 1st step, but shunt windings cut out, making two series motors in series; 3rd step: Battery in series and two compound motors in series; 4th step: Same as 3rd step, but shunt fields cut out; 5th step: Battery in series and two compound motors in parallel; 6th step: Battery in series, shunt windings cut out.

refuse, and the same arguments in favour of electric vehicles apply.

The electric vehicle is in use on the Continent and in the United States in connection with street cleaning and brushing machines and for watering, one important Continental city having about 30 in use. In the city referred to, each electric watering van waters about 49,000 square yards of road surface per day of eight hours, as against 30,000 yards, the best average of a horse-drawn van. The saving stated to result from employing "electrics" in place of horse-drawn vans for this purpose by the municipality mentioned is about £80 per electric van per year. The electric vehicle is also employed for carrying materials used in the making and repair of roadways, and a 3-ton wagon with tipping body has just been put into service for this purpose by the Corporation of Ipswich. In reality, this wagon will be a "double-purpose machine," since the tipping body is removable, and can give place to a water-tank (which is now being constructed) to enable the vehicle to be used for street watering. The energy consumption is on the average under 0.75 unit per mile.

It has been suggested that an electrically-driven road roller would be an improvement upon the noisy steam roller generally in use. Although, as far as the Committee's knowledge goes, no electrically-propelled rollers have yet been introduced, there appear to be obvious advantages in that method of working and no difficulties in applying it. As weight is an essential requirement, a battery of as large a capacity as necessary could be fitted.

The Tramways Department.

There are now three municipal tramway undertakings making use of the electric battery 'bus as an adjunct to their tramway services, *i.e.*, Southend-on-Sea, South Shields, and York. In all three instances, it is understood that the vehicles are giving satisfaction.

Apart from the features of economy, silent running, general cleanliness and simplicity, a strong argument for the adoption of electric vehicles, as against petrol or steam-driven ones, by a tramway department lies in the fact that their use entails no augmentation of the repair staff by specially experienced men, because the equipment, except the battery, being similar to that upon a tramcar, the ordinary repair staff can quite easily do all repairs needed.

The South Shields Corporation 'buses have accommodation for 22 passengers, the speed being 12 miles per hour on the level and about 6 miles per hour on gradients of between 1 in 8 and 1 in 10. The energy consumption per mile varies with the condition of the roads, being, under the best conditions, about 1.3 units, while the figure runs up to about 2 units per mile when the roads are deep in thick sticky mud. On a fine day, each 'bus will run, if necessary, 50 miles on one charge. A charging station is placed at one terminus, enabling each 'bus to be given a boosting charge several times a day, which enables a fast service to be obtained during the evening without the necessity of charging during the station "peak-load" hours. Up to date, the maintenance cost has been practically nil, and the reliability of the vehicles receives cogent attestation in the statement of the tramways manager:—"One does not have to worry about them any more than one would about an ordinary tramcar."

The 'bus which the Southend Corporation Tramways Department has had in use since June 26th, 1914, is similar to those at West Hartlepool (?Bromwich.—Eds.). The experience at Southend, however, is perhaps a little more valuable for the reason that other 'buses of the petrol and petrol-electric type, and of the most modern make, have also been in use alongside the electric 'bus. In a report presented to his committee at the end of 1914, Mr. Birkett, the engineer and manager of the combined electric supply and tramway undertakings, dealing with the running of all three types, says:—"The electric 'bus is the most reliable and free from breakdowns. This is no doubt owing to the simplicity of the mechanism."

After going on to detail the troubles which have been incidental to the operation of the other two types, he adds:—"The electric 'bus is so free from moving parts, there being only the motor with chain drive and differential, that stoppages due to breakdown of parts are almost negligible. It will be apparent that fewer spare 'buses of the electric type will be needed in a large fleet as compared with petrol 'buses . . . . Providing all necessary plant for re-tiring wheels is available, there will be no reason for possessing a stand-by electric 'bus with a fleet of six 'buses. . . . It follows that the staff at the garage would be affected in favour of the Edison 'bus."

As to cost of operation, after eliminating from the cost ascertained up to date, certain items in connection with each type of 'bus which are incidental to the inception of a 'bus service, Mr. Birkett gives the actual average cost per 'bus mile (including capital charges) for each type as follows:—

Petrol	8.56d.
Petrol-electric	8.31d.
Electric	7.52d.

Mr. Birkett further points out that, in his opinion, the results would be still further in favour of the electric battery 'bus if a fleet consisted entirely of the latter.

The consumption of energy on the hilly route is at the rate of 1.55 units per mile, while on a route which is more or less level, the figure comes down to 1.1. The 'bus receives a short boost while waiting at one terminus, the boosting current being about 300 amperes. The average speed, including stops, is about nine miles per hour. Up to date there have been no repairs needed to the electric vehicle.

Battery 'buses are on order for the West Bromwich Corporation and for a company at Loughborough.

The Ilford Council Tramways Departments employ an electric tower wagon which has now been in service for over twelve months. The special advantages claimed for the electric vehicle for this work are:—

(1) Can be started away without loss of time.

(2) So simple that any workman can easily drive it, in consequence of which several men may be provided with licences, ensuring that whenever the call may come, a driver shall always be available.

(3) More easily manœuvred against poles or under insulators and wires than a petrol or horse wagon.

(4) Hand-lamps on flexibles, for night repair work, may be operated from the battery.

(5) Reduced risk of fire when garaged at the tramway depôt.

(6) Low cost for operation and upkeep.

Although the Ilford wagon weighs some three tons, the energy consumption is only a little over a unit per mile. With the exception of the cost of a little distilled water for the battery, no expenditure has been necessary for maintenance during the time the vehicle has been in commission, and there is stated to be no sign of wear upon the tires.

Similar vehicles are in use by, or on order for, the tramway departments at Derby and Belfast.

Other Uses.

There are still many districts where cesspool emptying has to be done, and, where the health and comfort of the residents is studied, the vacuum tank system has taken the place of the old and crude methods. It is possible to construct an electrically-propelled vacuum tank wagon—the usual capacity required is about 350 gallons—fitted with an electrically-driven air pump. As such a pump will only need some 2 horse-power to drive it, the ordinary size of battery fitted to a 3-ton wagon would easily supply the energy required. Ordinary labourers could work the plant, the cost of working and upkeep would be small, and the plant would operate with absence of noise.

The expenses of conveying the municipal officials about, on their business visits and rounds, aggregate into a fairly large annual sum in any town of size, and this is especially the case where hired vehicles are concerned. It would undoubtedly pay any large municipality to invest in a few electric cars for such service, which could be garaged with the electric supply or tramway departments. The simplicity of control is such that chauffeurs would hardly seem necessary. The figures already quoted in this report indicate how low is the running cost of the passenger "electric," and this feature, as well as the fact that the vehicle is free from all the starting difficulties, the vibration, and the fire risk of the petrol type, should act as a strong incentive towards its adoption for this particular service.

The "Point Five" Association.

On Thursday evening, June 17th, the members of the Point Five Association met at the Tricity Restaurant, Oxford Street. The proceedings, which were prefaced by an excellent little dinner, were quite informal.

Mr. S. E. Fedden (Sheffield), in the chair, expressed the hope that in such a period of stress "they would excuse him for not contemplating such matters as the grilling of chops," and dealt briefly with the general position created by the war, particularly as regards electricity suppliers. The last six months of 1914-15 had shown an output of 29 million units at Sheffield, as compared with 16 million units for the same period of 1913-14. In addition, 10,000 kw. of connections had been applied for or was being connected, and a further 10-15 million units output was in prospect. He estimated next year's output at 65 million units, as against 45 millions last year and 26 millions the year before. The difficulty was to extend the plant and to obtain coal. They would have to pay 10s. per ton more (making 18s.) for their next coal contract, and in all three or four principal items in electricity cost would in their case cost £23,000 extra next year. As regarded electric cooking, they wanted a hot plate that got hot quickly and showed it was hot; pilot lamps were not noticed, and apparatus must be designed for servants' use.

Mr. A. S. Blackman (Sunderland) expressed his satisfaction with the Carron cooker in use; it had fast and slow hot plates and would cook bread, which was a necessity in the North of England. They made a point of regularly inspecting flexibles and had had much success with Thermoid flexible, which was better than anything else so far tried. Their coal was supplied under contract at 1s. per ton less than last year.

Mr. Thos. Roles (Bradford), in the matter of coal, was in a similar position to the last speaker at present (paying 1s. 3d. per ton less), but he expected to pay over 60 per cent. more on the next contracts. He regretted the trend of the discussion which had taken place in the morning on the Point Five Tariff.

Mr. Cooke (Luton) agreed that they must have a red-hot hot plate and one which cooled rapidly. In the last few months their load had grown so quickly that they had placed an order for a 3,000-kw. set for next winter; the only difficulty in regard to coal was the price, which demanded Government action.

Mr. S. E. Britton (Chester) said he had used a Thomas electric cooker for five years with only one failure, and it did not present any difficulty to a servant. He used two red-hot hot plates, one with one heat and the other with three heats, which was most useful in the kitchen. Two years ago they had an exhibition where the Co-operative Society baked bread electrically, and it was the most perfect bread he had seen. The rise in the price of coal meant very little at Chester, where water power supplied a large proportion of the units.

Mr. Hame (York) had used several types of electrical cooker: it was an advantage to get the cooker into a house where it was under the eye of the owner, and not much good in large houses.

Mr. Pickvance (Wrexham) protested that the discussion in the morning missed the real point—the ½d. tariff—and dwelt on the method of arriving at the fixed charge. His experience of electric cooking did not reveal many failures of apparatus; the latest Belling hot plate appeared to be very successful.

Mr. Sauvage (Wrexham) agreed as to the disappointing character of the morning's discussion: the rateable value basis was a detail to be fixed by local conditions, and Mr. Davis (Ilford) urged them to renewed efforts, which would result in the manufacturers producing the right apparatus.

Mr. Shaw (Ilford) had used electric cooking for years, and agreed that apparatus must be constructed with a view to use by servants, and that red-hot hot plates were wanted.

Mr. Hoadley (Maidstone) said he had used electric cooking for a long time, and while the weekly units used by a servant were over 50, his own wife would do the same work with 30 units. He used a red-hot boiling ring.

Mr. Bowden (Poplar) said in their case coal had doubled in price in a year; one trouble was the shortage of trucks, and they had hired 40 and were running them continuously and getting coal at the contract prices fixed in November last. He agreed that the Point Fives were unlucky in the morning's discussion; his only issue with them was the method of assessment. He was convinced that the red-hot hot plate would come to stay.

Mr. Woodhouse (Yorks. Power Co.) said it was clear that in the morning the Point Fives had not stuck to the "point." Both the price of coal and labour would be permanently higher as a result of the war, and this would be all to the advantage of the electricity suppliers. As regards the increased prices asked for coal, it must be remembered that the war bonus to colliery workers represented a loss to the owners on contracts running at old prices.

Mr. Allen (Wolverhampton) said his coal was costing more, but he had arranged a contract for 25,000 tons of cooke breeze at a low figure, which would help things. Comparative tests showed that considerably less units were used with the red-hot than the black hot plate, and he was convinced that it was the type of the future. He used both the bright and black types of oven with a view to finding which was preferable in practice, and, so far, it appeared that each type had its favoured uses. In Wolverhampton, flexible troubles amounted to 2 per cent. per annum; flexible was often too light. His department did all the renewing of irons, etc., and sent inspectors round.

Mr. F. C. Raphael said it was not his experience that flexibles gave much trouble.

Mr. W. R. Cooper supported the Point Five policy, but could not specify the brand of assessment, though he felt up against the inclusion of a garden in the assessment.

Mr. Barham (Watford), in the matter of the apparently greater destructiveness of alternating than direct current to apparatus, suggested that this should be carefully considered by the Association, and the Chairman mentioned the necessity of fitting lock-nuts on stove elements on alternating circuits. He added that it was impossible to bake bread in a little oven.

SUBMARINE SIGNALLING.*

By R. F. BLAKE.

Sound signals produced in air are very erratic in their range and intensity, so much so as to be on many occasions absolutely misleading. Water has many advantages over air for this purpose. It is free from the dangerous zones of silence which occur when the signals are produced in air; the absorption of the sound is much less in water, and consequently the signal is not only absolutely reliable but is transmitted to a distance many times greater than when it is transmitted through air; the sound is not carried away by the wind in stormy weather, as is the case with the siren; it is not affected by atmospheric disturbances, as in the case of wireless. It permits of the accurate determination of the direction from which the sound is proceeding, which is not the case with either the air siren or wireless telegraphy.

Up to the present time the sum of a million dollars has been invested in developing submarine signalling, so far without monetary return.

The first method which was employed for producing the sound was through the striking of a bell, and the method of receipt of the signals was by means of a microphone attached to the skin of the ship. Neither the original bell nor the original microphone attachment was satisfactory, but finally the work of Mundy, Wood, Fay, Williams and others resulted in a completely practical system.

The submarine bell in use on lightships is actuated by compressed air stored in a reservoir. The actuating wheel has projections mounted on it, so that when the wheel revolves a number of strokes follow each other, the different intervals being peculiar to the different signal stations. In order to receive the sounds, it has been found absolutely necessary to suspend the microphone in a tank of water, for this is the only method of cutting out noises which otherwise drown the sound of the bell.

One of these small water tanks, containing a microphone of a special type, is attached to each side of the bow inside of the ship. From each tank wires are run to a device which is called the indicator box, so arranged that by throwing the handle to one side, the starboard microphone is connected to the telephone, and by throwing the handle to the other side, the port microphone is connected.

It will be obvious that once the bell is picked up, the captain has only to turn his vessel until the sound is heard with equal intensity on each side, to know that his ship is then pointing in the direction from which the sound is coming, and in this way he can take compass bearings of the lightship on which the bell is situated.

Even if no further development had been made, the system would be—and is—a complete and practical one. Its universal adoption would greatly minimise if not entirely prevent disasters due to errors of ship position.

If the sound-producing apparatus could be so constructed as to be operated from moving ships by a telegraph key, it would be possible for one ship to signal to another in fog, to communicate its position, its direction, and its speed, and to eliminate all dangers of collision. It would also be possible to signal between submarines or between battleships and submarines, and to communicate between battleships in action without interference from the enemy and though all masts were shot away. If the sound-producing apparatus could be constructed so as to be actuated by telephonic currents, it would be possible to transmit speech through the water.

Serious difficulties had to be overcome before the desired results could be obtained. Since water is almost incompressible, any apparatus which is to transmit sound through water must be capable of exerting very great force, comparable with that produced by the impact of a hammer on an anvil. Some material object must be set in motion to compress the water, and that object must start from rest, reach its highest velocity, and come to rest in one-thousandth part of a second,

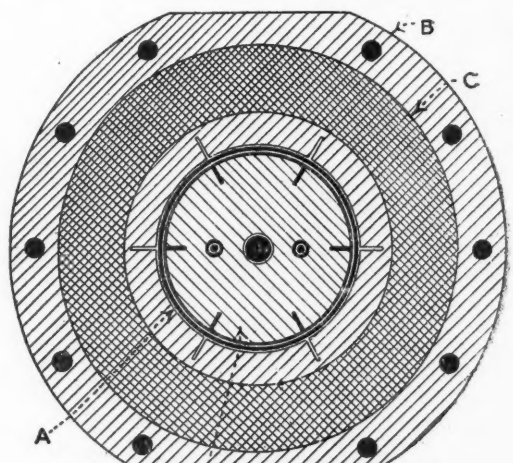


Fig. 1.—Cross-section of the Fessenden Oscillator.

if a musical note having a pitch of five hundred per second is to be produced. The forces of acceleration thus necessitated are very large.

Whatever device is used must be capable of producing at least 100 compressional waves per second, in order to telegraph satisfactorily at the rate of 20 words per minute; to transmit speech through the water, it must be capable of producing several thousand waves per second.

The apparatus, as finally developed by Professor R. A. Fessenden, is termed an oscillator, and its construction is shown in cross-section in fig. 1, in which the iron of the magnetic circuit and the copper tube are shaded. The magnetising coil is cross-hatched. The moving part is the copper tube A. This lies in the air gap of a magnetic field formed by a ring magnet B, built up in two parts, as shown in longitudinal section in fig. 2.

The ring magnet is energised by the coil C, and produces an intense magnetic flux across the air gap containing the

* Abstract of paper read before the American Institute of Electrical Engineers.

copper through the central stationary armature D. This field is very much stronger than that in the ordinary dynamo, there being more than 15,000 lines per cm². of cross-section.

Around the armature is wound a fixed winding, which is reversed in direction so that one half of the winding is clockwise and the other counter clockwise. When an alternating current is passed through this armature winding, it induces another alternating current in the copper tube.

Only by this construction has it been possible to obtain the enormous force and rapidity necessary to compress the water and to overcome the inertia of the moving parts of the mechanism.

In order to apply this force to the work of compression, the copper tube is attached to solid disks of steel, which are drawn together on the tube by a one-inch vanadium-steel rod and a right- and left-handed screw thread, and are attached to a steel diaphragm one inch thick, which may be made part of the side of the ship.

Telegraphing is accomplished by means of an ordinary telegraph key placed in the main armature circuit. There is no sparking at the contacts, although a very high frequency is used, five hundred per second, and there is no laminated iron used in the construction of the apparatus. The secret of this lies in the fact that the armature has substantially no

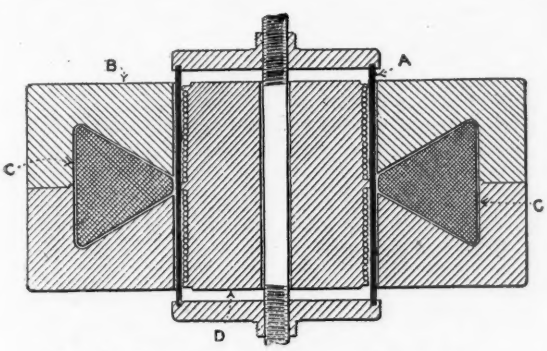


FIG. 2.—LONGITUDINAL SECTION OF OSCILLATOR.

self-induction, and no eddy currents are generated in the apparatus; the copper tube forms the short-circuiting secondary of a transformer, of which the armature winding is the primary.

This eliminates the self-induction of the armature winding. In addition the upper and lower portions of the winding are wound in opposite directions, and therefore there is no mutual induction between the field coil circuit and the armature circuit. With this construction, the amount of magnetic leakage in the armature circuit is very small, only a trifle more than if the armature core were of wood, and as there is no alternating magnetic flux in the iron, there are no eddy currents.

The capacity in kilowatts of this apparatus is large; the winding being in grooves in the armature core, so as to withstand the mechanical forces acting upon it, is well cooled.

The copper tube has no insulation to be affected, and on account of its large cooling surface and high permissible temperature of operation, can carry very high currents without injury.

When the oscillator is placed on a vessel or hung overboard from a lightship, a large water-tight diaphragm is attached to the oscillator. This particular type of oscillator was first tested by suspending it in twelve feet of water at the Boston lightship, and the signals were heard plainly with a microphone lowered overboard from a tug at Peaked Hill Bar Buoy, thirty-one miles away. Since that time tests have been made with oscillators installed in the fore peak tank of the *Devereux*, a collier of the Metropolitan Coal Company, and also with an oscillator mounted on a diaphragm made part of the hull of the vessel. The signals have been heard upwards of twenty miles from the *Devereux* running at her regular speed of eight knots. Full power has not been employed on any of the tests, and it is more than probable that much longer distances can be attained in the future.

In addition to the tests already described the oscillator has been temporarily installed on submarine boats, and demonstrated that a flotilla of submarines equipped with oscillators will be able to make a combined attack on an enemy, only one needing to show its periscope in order to direct the others, or all of them can be directed by the mother ship. It therefore makes possible a whole field of submarine manœuvres heretofore out of the question; and perhaps most important, it removes the principal danger these boats have had to face, the risk of being run into.

The signals produced by the oscillator can be received by water-immersed microphones of the usual type. One would perhaps not anticipate the possibility of using the oscillator as a receiver, in view of the fact that the diaphragm is of solid steel, and weighs, with the copper tube and its attachments, considerably over 100 pounds; but the oscillator, like the ordinary electric motor, is also capable of acting as a generator, and on account of its high efficiency as a motor, is a very efficient one.

The same oscillator is therefore used for sending and for receiving, a switch being thrown in one direction when it is desired to telegraph under water, and thrown the other way when it is desired to listen in.

In addition to telegraphing and receiving messages, the oscillator can also be used for telephoning under water. Sentences have been transmitted at 800 yards and conversation at more than 400 yards, and this was accomplished with the use of an ordinary telephone transmitter and six dry cells.

It seems evident, therefore, that with more power much greater distances can be reached. Long distances are not, however, necessary, as even with a distance of one mile it will be readily understood that this method of under-water telephoning will be of great use as a means of communicating between submarines while submerged, and between ships in fog, as the captains of the vessels can talk directly to each other, instead of transmitting and receiving through a telegraph operator.

In April, 1914, some tests were made on the U.S. revenue cutter *Miami* to see whether soundings could be taken by echo from the sea-bottom. The echo was plainly heard not only on the oscillator, but in the wardroom and in the hold of the ship without any instruments whatever. The elapsed time corresponded to the depth shown on the chart, and the proposed method was proved to be feasible.

The chief object of the tests on the *Miami* was, however, to determine whether a reflection from icebergs could be obtained, and this was proved beyond question.

A signal was sent on the oscillator, the echo from the bottom heard, and then the echo from the iceberg came in. To make sure that the second echo was not also from the bottom, the distance from the *Miami* to the iceberg was varied from about 100 yards to 2¼ miles. The elapsed time between the signal and the echo from bottom remained the same, but the elapsed time of echo from the iceberg varied with the distance and corresponded very closely to the position of the iceberg determined by the range finder. Moreover, it was found that it made no difference whether the face of the iceberg was normal to the path of the sound or not, thus showing that the echo was due not to specular reflection but to diffraction fringes.

[In a popular article on this subject recently published in the *Strand Magazine*, it was stated that the Fessenden system had been adopted by one of the European nations for use on its submarines.—EDS. ELEC. REV.]

AN ELECTRICALLY-DRIVEN MILL.

AN example of the benefits accruing from the electric drive of textile mills is found in a doubling-frame installation carried out by the General Electric Co., Ltd., at the New Bridge Lane Mills of Messrs. Thos. Reynolds, Ltd., of Stockport. In this installation the main "Witton" generator, of 150 KW. capacity, is driven through ropes from a main mill engine, and, running at 385 R.P.M., delivers three-phase power at 500 volts, 25 cycles. On the same shaft is coupled a D.C. generator, which supplies the exciting current for the alternator as well as current for the lighting of the mill. A 120-H.P. "Witton" three-phase slip-ring motor, running at 490 R.P.M., drives about 6,000 spindles from a central point. This motor works in conjunction with two 45-H P. water turbines, which draw their water from the River Mersey. The motor, which is shown in fig. 1, is of sufficient capacity to take the full load of the 6,000 spindles when the water supply fails.

When water-power is available, the arrangement is such that the turbines take as much load as the water supply will permit, and the motor develops the additional power. This is accomplished by means of a special clutch whereby when, through the scarcity of water, the speed of the turbines drops, they are instantly cut out and the motor takes the full load. As soon as the speed of the turbines comes up again, the clutch acts to effect engagement between the turbines and the motor, so that the load is shared as before.

In another part of the mill are installed 10 doubling frames aggregating 4,000 spindles. These frames, which are illustrated in fig. 2, are individually driven by three-phase squirrel-cage "Witton" motors taking power at 500 volts, 25 cycles, and running at a speed of 1,490 R.P.M. Each motor is mounted on a bedplate complete with oil-immersed chain drive in a cast-iron case, which enables the tin roller shaft to be driven at the correct speed through a friction clutch and a flexible coupling. The drive is so arranged that by disconnecting the flexible coupling the whole gearing can be slung over approximately 45°, thus making the frame gearing accessible without in any way interfering with the motor or its gearing.

The motors are run up to speed by star-delta starters of a compact design, which are conveniently situated in proximity to the motors. These starters are simple in operation, and can be left in the control of the workpeople, to whom they present no difficulties

They are provided with devices which prevent the workmen making a mistake in the starting-up operation, and fully protect the motor against damage.

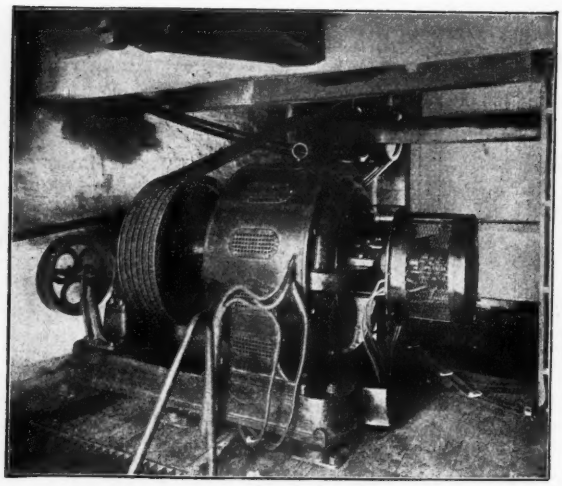


FIG. 1.—120-H.P. "WITTON" MOTOR DRIVING PART OF THE MILL.

The main switches controlling the motors are shown in the background of fig. 2. They are of the standard G.E.C. "Salford" pattern, and are provided with fuses.

This installation has solved for the owners a difficult problem, as the small headroom available would have made the installation

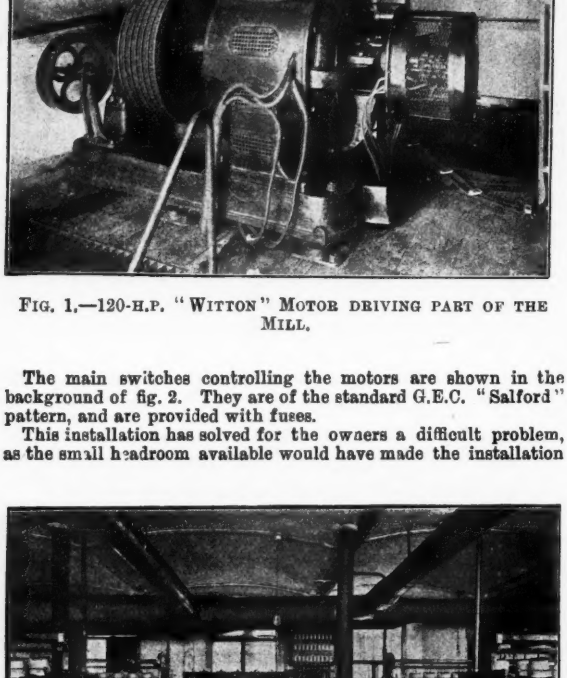


FIG. 2.—INDIVIDUAL-DRIVE "WITTON" MOTORS WITH OIL-IMMERSED CHAIN DRIVE; THE MAIN SWITCHES CONTROLLING THEM ARE SHOWN IN THE BACKGROUND.

of mechanical transmission a perplexing question, which at the best could only have resulted in an inconvenient solution. We understand that the owners are entirely satisfied with the application of electricity for driving their mill.

LEGAL.

INTERNED GERMAN AS PLAINTIFF.

IN the City of London Court, on June 25th, before his Honour Judge Rentoul, K.C., the H.N. Battery Co., electricians, 16, Barbican, sued Messrs. Harvey, Taylor & Co., medical and dental electricians, 253, Gladstone Avenue, Wood Green, for £4 15s. for electric lamps supplied. The defendant Taylor said that the plaintiff company was an alien enemy. The real plaintiff was H. Neuberger, and he was trading as the H.N. Battery Co. The goods sued for were sold in July of last year. The Judge: At that time the Germans were our best friends. Defendant said that the money did not become due until after the war began. The Judge did not see why the defendant should not pay. It might be his duty to keep the money in Court to prevent it from going abroad. Plaintiff's representative, named Sim, said that the account was for April and May. The proprietor of the business was Neuberger, who was interned on the previous Tuesday. Witness was looking after the business in the meantime. The Judge: You are winding it up? Mr. Sim: No, keeping it on. He is applying for exemption from internment on certain grounds, and he hopes that he will be successful. The Judge said he must find for the plaintiff, with costs, but the money would stay in Court until after the war.

OSRAM LAMP LITIGATION.

IN the Chancery Division, on June 22nd, Mr. Justice Joyce commenced the hearing of an action by the Osram Lamp Works, Ltd., of 31, Copthall Avenue, E.C., against Pope's Electric Lamp Co., Ltd., of Hythe Road, Willesden, for an injunction to restrain the defendants from infringing the plaintiffs' Letters Patent 23,899* of 1904, for damages, and for the delivery up of articles or things made in infringement of the said letters patent. The defendants denied that they had infringed the letters patent, and alleged that there was no subject matter for the plaintiffs' patent and a want of novelty.

Mr. A. J. Walter, K.C., Mr. H. A. Colefax, K.C., Mr. J. Hunter Gray, and Mr. Lunge appeared for the plaintiffs; Mr. T. Terrell, K.C., Mr. T. R. Hughes, K.C., and Mr. E. Russell Clarke appeared for the defendants.

MR. WALTER informed his Lordship that this action related to incandescent electric lamps, and more particularly to the filament in such lamps.

After explaining the history of the subject and the state of the art when Just & Hanaman made the invention which was in the Specification 23,899 of 1904, COUNSEL said that that was a patent for manufacturing a tungsten filament, and these patentees discovered that tungsten if taken in metal form or in the form of its oxides or sulphides, mixed with an agglutinant and formed into a thread, and carbonised so as to form a filament of tungsten and carbon, could be protected by an atmosphere of hydrogen in the further process of burning out the carbon. Dr. Welsbach had discovered that this was the case with osmium and the metals of the platinum group. These inventors discovered that it was also the case with tungsten, and that you could burn out the carbon by means of the oxygen in steam without injury to the metal, which would be protected by the hydrogen.

In a previous action by the Osram Co. against the "Z" Electric Lamp Co., Ltd., this patent had been considered by Mr. Justice Warrington. In that action practically every one of the objections taken to the plaintiffs' patent in this action was taken and overruled. It was suggested in the "Z" action, and it was again suggested here, that there was no subject matter in discovering that tungsten could be protected by hydrogen from the action of oxygen. Mr. Justice Warrington held that there was invention in it, and that there was nothing in chemistry which would have taught a person that because osmium and the metals of the platinum group would be so protected, the metal tungsten could also be protected by hydrogen; in fact, titanium, zirconium, and thorium could not react in this way. According to the defendants' case, Welsbach, when he made his invention, though he was, in fact, treating osmium and the metals of the platinum group, must have known that tungsten, a metal otherwise possessing desirable qualities, would be susceptible to the same treatment. But, until this specification, no one ever suggested that this was the fact. This specification formed the basis for the manufacture of tungsten filaments in this country, and tungsten had substantially replaced carbon filaments for commercial lighting. There had been a subsequent development, and means had now been found for the working of tungsten. That patent had not yet been before the Courts, but it would soon be. The defendants operated by two methods, but they used a carbonaceous binding material, and they took as their raw material a mixture of finely divided tungsten and a small quantity of one of the oxides of tungsten. These were the metals referred to in the specification. They mixed that metal with an organic binding material, and they made threads by a process of squirting. Thus they obtained a thread of tungsten material bound together with carbon. These filaments were dried so as to have some sort of form, and then there were two alternatives in the first process. They had furnaces of iridium, down the walls of which an electric current flowed so as to heat it at the top to a temperature of about 950° C. Lower down the temperature was lower, and the bottom was cooled by a water jacket. Hydrogen was passed into the interior of the furnace, and hydrogen was also brought round the furnace to prevent the possibility of anything but hydrogen getting inside. The filaments, which had been squirted and dried, were put upon a holder from which they hung and passed very gradually from the bottom of the furnace into gradually increasing heat. When they got to the top they remained there a certain time and then passed down again into the cooled part, from which they could be taken out. They were, therefore, in an atmosphere of hydrogen, being first carbonised in the lower and cooler portions of the furnace. When they got to the higher portions the hydrogen acted on the oxygen of the tungsten oxide, steam was formed, and the oxygen in the steam burned out the carbon precisely as indicated in the specification. The same process appeared to be carried out partly not in the iridium furnace, but in a porcelain furnace, which was heated electrically to a temperature of 950° C. The chemistry of the operation which took place in the porcelain furnace was precisely the same as in the other. Whichever method was adopted the makers had now got rid of some of their oxygen, and they wanted to get out more

carbon, and they wanted to make more steam. After the cooled filaments were removed from the furnace they were therefore heated in an oven exposed to the air up to a temperature of about 220°. By this means some tungsten was oxidised. Then the filaments were passed into another iridium furnace into which hydrogen was flowing at the top, where the maximum heat was 1,850° C. As in the previous case, the furnace was cooled at the bottom, and the filaments were gradually raised through the increasing heat, and in the same way vapour was formed. This operation was, therefore, also carried out in an atmosphere of steam and hydrogen, and the carbon was oxidised while the tungsten was protected. Electricity played no part in the process other than heating, and it was much the same as if current had been run through the filaments themselves in a prepared atmosphere in the manner described in Just & Hanaman's specification. The second of the two processes to which he had referred was carried out by means of quartz or silica tubes about 2 ft. 6 in. long and about 2 in. in diameter. These were sealed at one end and were fitted at the other end with a cover by which they could be connected to an exhaust pump. The filaments were put on to a holder and put inside the tube. The vessel was then closed and the air pump put to work. The quartz tube was put into an electrical furnace and heated up to 950° C., the exhaust pump continuously working. Hydrogen with steam and carbonic oxide were the gases that came out of the tube, so this process was essentially the same as the others. The tube was taken out of the furnace in due course and allowed to cool. When cool it was put into an exposed oven heated up to 220° C. More tungsten oxide having been formed in this way, the filament was again put into the quartz tube and the process was repeated in a final furnace heated up to 1,850°. Thus the one method of treating the filaments was carried out in a vacuum, the other in a stream of hydrogen, but in both the atmosphere was that described in the plaintiffs' specification.

DR. FRANCIS WM. PASSMORE, a consulting chemist, said in evidence that for the purposes of this case he had studied the specification sued upon and the prior documents which were urged against its validity. On several occasions he had attended when the defendants afforded inspection of their process. He had also carried out a large series of experiments. Taken through the plaintiffs' specification by Mr. Colefax the witness agreed that, following out the invention as described in this specification, filaments of pure tungsten or substantially so were obtained which did not possess the defects of those where tungsten had been applied as a coating. The directions given were, in his opinion, sufficient to enable one to carry out what had been described. He did not find disclosed in any of the documents that were pleaded against this patent the idea of using a filament of pure tungsten, except in the case of drawn wire, No. 20,277 of 1904, the patent granted to Abel on a communication from Siemens & Halske, and the German patent of Just & Hanaman, No. 154,262. In none of those documents did he find any suggestion that for the purpose of obtaining a tungsten filament substantially pure one could use the process described in the plaintiffs' patent. The two patents mentioned, 20,277 of 1904 and the German patent 154,262, were referred to in the disclaiming clause of the specification. He considered the Just & Hanaman an epoch-making invention. At the date of Just & Hanaman's specification no means were known by which one could obtain a drawn-wire filament. With regard to the suggestion of Just & Hanaman in their German specification No. 154,262, one could make a tungsten filament following that process, but it was not pure. It was known that a stream of hydrogen would remove carbon from the admixture with tungsten, but whether or not it would leave the tungsten filament intact no one knew. Welsbach's specification 1,535 of 1898 referred entirely to osmium or a metal of the platinum group. He did not think Welsbach's specification would have told anyone in 1904 of the possibility of making a built-up filament by the Just & Hanaman process. Nor did he think that any assistance could have been got from the specification of Gulcher, which mainly related to iridium, which Gulcher proposed to sinter. Bottone dealt with tungsten, but his object was merely to produce carbon filaments strengthened by tungsten, and there was no suggestion in Bottone's specification of a paste of tungsten or a compound of tungsten and a binding material from which the carbon could subsequently be eliminated and the tungsten retained. Similarly the two Lodyguine specifications related not to a paste process, but to claims for a body containing a fillet without any process for getting rid of the fillet. He found in the specification of Just sufficient directions to enable him to put the invention into practice.

HIS LORDSHIP: I apprehend the greatest possible difficulty as to whether the process which the defendants are operating is the patented process. The other questions as to the validity of the patent, and so on, one can understand, but I suppose defendants are going to say it is not the process patented. Your witnesses will have to explain this to me clearly. It is an issue I don't look forward to with any pleasure.

MR. TERRELL: It seemed to me that for the purpose of enabling your Lordship to deal with this particular issue, it would be desirable that you should see the process at work.

HIS LORDSHIP: I don't think I am going to do that. In these cases I bear in mind that I am not bound to be an expert. I have no doubt that scientific witnesses will be called, and I shall have to do the best I can.

DR. PASSMORE then proceeded to describe the defendants' processes, which were explained by Mr. Walter in opening.

He said that in the vacuum process the filaments were, after the first furnacing up to 950°, put into an exposed oven heated up to 220°. In the next stage the filaments were transferred to the furnace and the first operation was repeated. Finally the filaments were transferred to a platinum-iridium furnace in which a stream of hydrogen passed downwards, and which was heated to 1,850°. Analyses of samples taken at the defendants' works were produced by the witness. From one of these it appeared that a filament, after squirting and drying, contained 2·32 per cent. carbon and 93·04 per cent. tungsten; the balance was made up of oxygen, hydrogen and nitrogen. At that stage carbonisation had not commenced. In another sample analysed, witness said the records showed that the carbon had dropped to 0·013 per cent., and the tungsten had risen to 99·95 per cent., after heating to 1,850°. At the very last stage the tungsten was brought up practically to 100 per cent.

MR. TERRELL then cross-examined the witness on behalf of the defendants.

Is the total result of your view, said Counsel, that with regard to this patent for the use of an atmosphere of gas, steam and hydrogen, however much they might try to avoid infringing it they cannot help doing it?—Witness: No. I think a pure tungsten filament can be made without using it.

But can a pure tungsten filament be made by means of the building-up process—that is the point?—Yes, without using this process.

Using a binder?—Yes.

And not using this process?—Yes.

Was there any usual practice of making filaments for lamps at the date of this patent other than the process for making carbon filaments?—Yes.

Where was it carried out?—That I cannot say. But I say from the literature it is quite evident there must have been.

Was there any furnace known in which you could raise a filament, or anything, to a temperature of 1,850°, and at the same time keep it in a gas such as hydrogen?—Certainly, I should think.

You knew that this specification of Just & Hanaman prescribes heating by an electric current?—Yes.

You knew perfectly well that the heating adopted by the defendants is in a furnace at which a temperature of 1,850° is reached in an atmosphere of hydrogen?—But the other temperatures are in an atmosphere of hydrogen.

You knew perfectly well that that was one of the issues in this action?—No, it never occurred to me that there was any distinction between heating in a furnace up to 1,850°, the furnace being warmed by electric current, and in the other case the filament.

Later MR. TERRELL said that some part of the process it had been desired to keep secret; but keeping this secret would, he found, hamper his cross-examination: and as the importance of keeping it secret had gone, he would abandon the idea of trying to do so. The binder that was used by defendants was composed of 20 parts of binder and 100 parts of metallic tungsten.—WITNESS said that was only right in respect of some filaments.

It is nearly always five to one, is it not?—It is always four to one for thin filaments and five to one for thicker filaments.

As to the composition of the binder, it is 68·8 per cent. amyl acetate?—I don't know that. What I have here is "Mix 243 grammes amyl acetate and 30 grammes castor oil; dissolve therein 30 grammes of camphor; then add 50 grammes nitro-cellulose; heat up to 130° C. in an oil bath for about half an hour. Filter through asbestos."

In the defendants' process they do not denitrate?—Not in the size of filament I saw.

Now consider Welsbach's second method. "The principle of this method is to take a carbonaceous filament and to cover it, or saturate it, with an osmium compound; and then by electrically heating the conductor so formed in a suitable protective atmosphere to burn out the carbonaceous matter, and thus to leave a coherent filament of osmium." Do you understand that he is going to pass an electric current through it?—Yes.

And by means of a protective gas he is going to oxidise the carbon while keeping the osmium in a reduced condition?—Yes.

Then he says: "Instead of a carbonaceous filament being taken I may use the equivalent method of a carbonaceous binding material." What do you understand by that?—He is going to take a powder of some osmium metal or a compound and mix it with a carbonaceous binding material such as collodion and make a paste and squirt a filament.

Then he goes on to describe what he does in detail. Later, he speaks of carbonising the organic matter by destructive distillation and getting rid of the carbon. The success of this operation of Welsbach's depends upon the knowledge that hydrogen will reduce osmium?—Yes, that is one of the necessary items of knowledge, but you must know a great deal more than that.

And he says: "As has been already stated, it is not necessary that the basis of the filaments should be organic fibres. They may be made from any convenient carbonaceous material which can be burnt off by the above process. Thus, the method used for the production of artificial silk may be employed." What does Welsbach tell you when he tells you that?—He means squirting a solution of cellulose into a setting bath.

If you read "metal tungsten" there wherever the word osmium occurs, is there any difference in the process described there and the process described in the specification sued upon?—There are two processes dealt with there, one with steam and hydrogen, and that would work.

He says: "A mixture of finely divided osmium and osmium compounds, such as sulphide and tetra-hydroxide, is mixed with the collodion, so as to render the mixture viscous and to keep the osmium from separating out by reason of its greater density. The magma is now formed into the desired shape as, for instance, by squirting it through a die. The collodion is then denitrated."

Is there any difference between the process there described and the process described by Just & Hanaman?—No.

It says: "The collodion is then denitrated and subjected to the process described above to burn off the carbon," and the process described above is: "When it is fixed it is gradually raised to a high temperature in a reducing atmosphere containing water vapour or hydrogen preferably of the kind before referred to which is obtained from the Bunsen flame; but mixtures of steam and hydrogen or of carbonic monoxide, carbonic dioxide and hydrogen can also be used"?—Yes, it is one of the processes described.

Do you say any one of the atmospheres described in Welsbach for osmium will not work quite well with tungsten?—I can't say; it depends on the composition of the mixture.

Do you say now that you are unable to say whether all these atmospheres mentioned by Welsbach for osmium will not also equally well work for tungsten?—I should certainly think not. It may be that they do, but reading this specification would not convey to my mind that they do, because my experience has been that even with a small amount of hydrocarbon, if tungsten is heated in an atmosphere of that kind there is carbon deposited. But it may be that you might discover some conditions under which it would work.

At any rate you are not prepared to say that experiments which show that they all work perfectly well with tungsten, as well as with osmium, are erroneous?—Certainly. They will not work as well with tungsten as with osmium.

Why not?—Because of the different nature of the metals. It is a matter of proportion.

Proceeding, Mr. Terrell read a portion of Mr. Justice Warrington's judgment in the "Z" case, in which the Judge said that Welsbach's process of decarbonising in steam and hydrogen had been tried by Dr. Lieman upon uranium, which is in the same group as tungsten, but without success. What is the reason, inquired Counsel, that uranium will not succeed in this process described by Welsbach?

WITNESS: I presume it oxidises.

You have tried several metals of the tungsten group yourself? Yes; tantalum, titanium, zirconium and thorium. All of those failed in the process of removing carbon in an atmosphere of steam and hydrogen.

It was a matter of text-book knowledge in 1904, was it not, that tungsten is reduced from its oxide by hydrogen?—Yes, that was one way of doing it.

Therefore would not everyone in 1904 know perfectly well that this process of Welsbach, so far as the steam and hydrogen part of it was concerned, would work?—No.

What other knowledge would you want to enable you to predict that it would succeed than the fact that it was reduced by hydrogen?—I should want to know what oxide was produced, at what temperatures, where reduction commenced, where oxidation commenced, before I could form any idea.

All that you would have been told by the common knowledge of the day?—No.

Are you in a position to say that tungsten was not one of the metals referred to in Siemens & Halske in 1904 as having been suggested for filaments made with the use of agglutinants?—I don't know about suggestions. I daresay it had been suggested that tungsten would make a very good filament. The question was how.

By the aid of agglutinants?—No, I don't think it had been suggested before.

(To be continued.)

ATTWELL *v.* WEST HAM CORPORATION.

LAST week, at the Bow County Court, the hearing of this case was resumed. Plaintiff claimed damages for injuries sustained due to an electric shock received while cleaning out a transformer station. Further evidence having been given by plaintiff, and by Mr. T. W. Baker, consulting electrical engineer, the hearing was again adjourned.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

8,726. "Self-acting electric fire alarm." A. P. SYMONS. June 14th.

8,736. "Combined electric switches and connecting plugs." R. MOORE. June 14th.

8,739. "Electric apparatus for driving clocks and similar mechanism." H. E. WARREN & WARREN CLOCK CO. June 14th. (Complete.)

8,748. "Regulating mechanism for dynamo-electric machines." J. MARTIN and BRITISH THOMSON-HOUSTON CO., LTD. June 14th.

8,770. "Electro-magnetic make-and-break devices." SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. June 14th. (Divided application on 16,080/14. Convention date, July 7th, 1913, Belgium.) (Complete.)

8,773. "Electro-deposition of metals." L. WIRTZ. June 15th.

8,806. "Electrical incandescent lamps." BRITISH THOMSON-HOUSTON CO., LTD. June 15th. (General Electric Co., United States.)

8,813. "Cell, battery, or refill for use in connection with portable electric lamps, and for other purposes." L. WAHL. June 15th. (Addition to 7,213/15.)

8,826. "Method of telephonic transmission without return wire." C. BARDELONI. June 15th. (Complete.)

8,829. "Electric heating and resistance devices." A. F. BERRY. June 15th.

8,850. "Electric meter." R. S. XENAKY & F. GILMAN. June 16th. (Complete.)

8,860. "Electrical resistances." A. H. RAILING, C. C. GARRARD & F. GREENHALGH. June 16th.

8,881. "Micro-telephones for portable instruments." F. KIRKBY. June 16th.

8,891. "Automatic and semi-automatic telephone systems." RELAY AUTOMATIC TELEPHONE CO., LTD., & W. AITKEN. June 16th.

8,895. "Arrangements for protecting telephone, telegraph, and the like instruments against lightning or excessive electric potentials." A. E. BEATTIE. June 16th.

8,903. "Electrical relays." V. TEDESCHI & A. G. ROSSI. June 16th. (Complete.)

8,907. "Anodes for the electrolysis of solutions of metallic salts." P. C. C. ISHERWOOD. June 16th. (Complete.)

8,923. "Method for the production of an electric discharge of high-frequency by means of sparks." R. J. BOURGEOIS. June 17th.

8,926. "Wireless telegraph receivers." MARCONI'S WIRELESS TELEGRAPH CO., LTD., & G. M. WRIGHT. June 17th.

8,927. "Wireless telegraph receivers." MARCONI'S WIRELESS TELEGRAPH CO., LTD., & G. M. WRIGHT. June 17th.

8,928. "Wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and G. M. WRIGHT. June 17th.

8,946. "Metallic lead-in wires for electric lamps, scientific apparatus and the like." J. F. DUKE. June 17th.

8,961. "Apparatus for detecting the presence of electric conductors." A. W. SHARMAN. June 17th.

8,980. "Insulating covering for telegraph and like wires." J. D. BRUNTON. June 18th.

9,003. "Miners' electric safety lamps." J. G. PATTERSON. June 18th.

9,012. "Secondary battery plates." ELECTRICAL POWER STORAGE CO., LTD., and W. SCHOFIELD. June 18th.

9,015. "Motor-actuated electric switches." LANDIS & GYR AKT. GES. June 18th. (Convention date, July 14th, 1914, Germany.) (Complete.)

9,021. "Electro-magnetic apparatus." W. F. JONES. June 19th.

9,023. "Ammeters and voltmeters." WALSALL ELECTRICAL CO., LTD., & V. DELEBECQUE. June 19th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1914.

3,701. ROTARY ELECTRIC SWITCHES. M. K. Ownbey. February 12th.

5,040. ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. R. Varley. February 26th.

5,841. CIRCUIT ARRANGEMENTS FOR SEMI-AUTOMATIC TELEPHONE SYSTEMS. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). March 7th.

7,746. COMBINED DYNAMO-ELECTRIC GENERATOR AND ELECTRIC MOTOR. W. Fox. March 27th.

8,683. METHOD OF REPAIRING ELECTRIC INCANDESCENT LAMPS. Electric Utility Co. & R. W. Long. April 6th.

10,930. ELECTRICAL LIQUID HEATER. A. Howard. May 4th. (July 11th, 1914.)

13,022. DYNAMO-ELECTRIC MACHINES, PARTICULARLY APPLICABLE FOR ENGINE-STARTING SYSTEMS. C. F. Kettering & W. A. Chryst. May 27th. (July 14th, 1913.)

13,022. DYNAMO-ELECTRIC MACHINES, PARTICULARLY APPLICABLE FOR ENGINE-STARTING SYSTEMS. C. F. Kettering & W. A. Chryst. May 27th. (September 13th, 1913. Addition to 13,022/14.)

13,076. MANUFACTURE OF TUNGSTEN. British Thomson-Houston Co. May 27th (General Electric Co.)

13,173. AUTOMATIC TELEPHONE EXCHANGE CONNECTIONS. Relay Automatic Telephone Co., formerly known as Betulander Automatic Telephone Co., G. H. Bryant & M. Ward. May 28th.

13,231. SYSTEMS OF CONTROL FOR ELECTRIC MOTORS. British Thomson-Houston Co. (General Electric Co., United States). May 29th.

13,232. LIQUID RHEOSTATS. British Thomson-Houston Co. (General Electric Co., United States.) May 29th.

13,310. SYSTEM OF ELECTRIC SIGNALS FOR MAIN AND TAIL HAULAGE IN MINES AND LIKE PLACES. G. B. Burrows. May 30th.

13,410. TELEPHONE SYSTEMS. M. S. Conner and R. E. Robinson. June 2nd.

13,549. MANUFACTURE OF METAL WIRE. British Thomson-Houston Co. (General Electric Co., United States). June 3rd.

13,709. STARTING APPARATUS FOR ALTERNATING-CURRENT MOTORS OF THE SLIP-RING INDUCTION TYPE. W. E. M. Ayres. June 5th.

13,715. ELECTRO-MAGNETIC LOCKING DEVICES. L. Cadenel. June 5th. (June 10th, 1913.)

13,854. MEANS FOR TELEPHONIC COMMUNICATION BETWEEN MOVING TRAINS AND RAILWAY STATIONS OR OTHER STATIONARY PLACES. T. G. Thornblad, R. H. Warlvinge & V. G. Werner. June 8th. (Convention date not granted.)

14,156. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. W. V. Williams. June 12th.

14,229. SHAPING FILAMENTS FOR ELECTRIC LAMPS AND THE LIKE. British Thomson-Houston Co. (General Electric Co., United States.) June 12th.

15,464. ELECTRIC STARTING DEVICES FOR INTERNAL-COMBUSTION ENGINES. L. Renault. June 27th. (July 12th, 1913.)

17,345. ELECTRIC HEATERS. H. Wilson & Co., Ltd., and W. R. Fairbairn. July 22nd.

17,732. AUTOMATIC ELECTRIC FIRE ALARMS. H. Dixon. July 27th.

18,677. TELEGRAPHY. E. C. R. Marks (Delany Foreign Co.). August 4th.

19,598. ELECTRIC SWITCHES. F. B. Holt. September 9th.

20,671. ELECTRODES FOR SECONDARY BATTERIES. A. Connell & H. S. Hohne. October 7th.

24,046. MANUFACTURE OF ELECTRICAL- AND OTHER HEATERS. J. A. Chell. December 14th.

1915.

1,600. ELECTRIC COUPLINGS. W. C. Lea. February 1st.

2,387. ELECTRIC LIQUID HEATER OF THE WATER-FLOW SERVICE SUPPLY TYPE. A. Howard. February 15th. (Divided application on 10,930/14, July 11th.)

3,003. ELECTRIC SWITCHES FOR MOTOR-CAR AND LIKE HORNS. A. H. Midgley and C. A. Vandervell. February 24th.

Fires.—Early on Wednesday, June 23rd, a fire occurred **at the Peel-Conner Telephone Works, Adelphi, Salford. The outbreak was discovered in the grinding room on the ground floor, and by the time the fire brigade had arrived the roof of the building had fallen in. After about half an hour's work the brigade got the upper hand, and prevented the fire from spreading to the main building.**

A fire also occurred last week among some large packing cases at the works of Switchgear & Cowans, Ltd., Springfield Road, Salford. It was quickly extinguished, the damage being very slight.